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NAVY AIR TO AIR MISSILE STUDY FIRE CONTROL REQUIREMENTS

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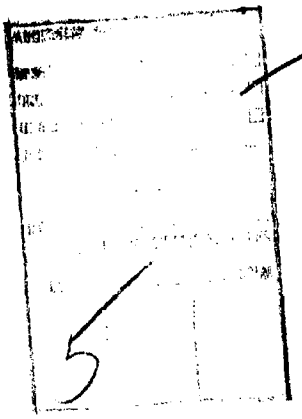

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ABSTRACT

The Naval Research Laboratory is serving as technical director of the Navy's Air to Air Missile Study. This report represents a continuation of this effort. Results are presented, based on preliminary investigation, which are directed toward establishing the minimum fire control requirements for successfully launching an air to air missile. The investigation was prompted by the fact that as missile system design techniques improve, fire control accuracy requirements should be less stringent. The question arises as to why this trend has not prevailed in the design of modern airborne fire control systems.

PROBLEM STATUS

This is an interim report; work on the problem is continuing

AUTHORIZATION

NRL Problem 53R05-04
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NAVY AIR TO AIR MISSILE STUDY FIRE CONTROL REQUIREMENTS

INTRODUCTION

This report presents the results of a preliminary analytical investigation, conducted by the Naval Research Laboratory, pointed toward establishing the minimum fire control requirements to successfully launch an air to air missile. Current airborne weapon control systems are complex and consequently require high level maintenance which still does not permit an acceptable availability status.

Systems of the past, such as the F4D Aero 13 had guns and rockets as primary armament. Experience showed that lead-collision rockets were the most effective tactical mode. This lead-collison course has only one instant of solution, where the rocket dispersion pattern results in a high kill probability, during the total attack conversion. It requires that accurate angle and range information be supplied to the computer. Current systems, such as the F3H Aero 19 and the F4H-1 Aero 1A utilize missiles (Sparrow III and Sidewinder) as a weapon. These missiles have some capability of correcting initial errors thus permitting missile launch with considerable angle and range errors in a pure pursuit or lead pursuit mode with continuous firing capability within a given range interval.

With the advent of missiles as a weapon it would seem logical that the tolerances of angle, range and computed parameters could be increased and still provide a satisfactory solution to the problem. This has not been the case, since the equipment designers tend to provide information to a higher degree of accuracy than necessary, because it is within the "state-of-the-art." Such exotic design philosophy increases the equipment complexity and vulnerability to enemy countermeasures. Complexity of circuitry and operational modes is a regenerative process because as system functions become more refined they become more susceptible to the natural environment as well as enemy generated countermeasures and consequently require additional refinement.

It is the intent of this analytical and simulation effort to devise methods of simplifying present system concept and still improve the probability of success through ease of operation, maintenance and improved reliability.

OBJECTIVES

In setting forth on this investigative study effort, certain broad objectives were established based on both analysis of NRL's tactical effectiveness studies and intuitive judgement. These objectives may be summarized as follows:

a. Define, in terms of probability of arriving at a successful launch point, present capability to solve the fire control problem, both in the clear and countermeasure environment, for the successful launch of today's and future air to air missiles.

b. Define actual accuracy requirements for launching air to air missiles.

c. Specify a system for solving the launching problem of air to air missiles.

To explore the initial objective of defining the Navy's current capability of solving the fire control problem, it was decided to select the most advanced interceptor system about which sufficient information was known to mechanize an accurate simulation.

The approach to this problem was to utilize the F4H-1 cockpit simulation in conjunction with the Reeves Electronic Analog Computer (REAC) located at the Westinghouse Air Arm Division. This simulation provides a pilot position with aircraft control stick, the instruments necessary to fly the aircraft and the APQ-72 search and attack display. The Radar Intercept Officer's (RIO) position is also simulated with the same radar presentation and radar control handle. These operating positions are connected into the REAC which simulates the characteristics of the F4H-1 aircraft and the Airborne Missile Control System (AMCS) Aero 1A (APQ-72 radar and APA-128 computer). A limited effort, although statistically sound, was made for the purpose of establishing parameter sensitivities and trends in quantities that would direct further investigative effort and system simplification taking advantage of insensitive parameters. One of the ground rules that was set forth was that the model (F4H-1 Aero 1A) would be used as mechanized in the initial investigations of the Navy's Air to Air Missile Study, thus establishing a standard to which future data might be compared.

GENERAL SUMMARY

With the simulation verified as representative of the F4H-1 weapon system a program to exercise the simulator was devised. Two hundred conversions were randomly flown in the "Normal Mode" (clear environment). The results of this set of conversions shows 83.7% capability of reaching a successful launch point.

The next step was to investigate the F4H-1 weapon system capability of solving the fire control problem in the "Home on Jam" (HOJ) mode. From the two hundred random conversions in this mode a probability of successful conversion of 73% was attained or 87% of those runs which succeeded under

normal conditions. This would indicate, that under the conditions examined, the system is not sensitive to absolute range. Presently the range information is accurate to within several yards and imposes considerable equipment complexity in the range track and timing circuitry to attain such accuracy. Considerable simplification should be possible in this area and plans are to exploit several schemes which will be discussed later in the text.

A third sequence of two hundred conversions was flown in the "Acquire on Jam" (AOJ) mode. The conditions for this exercise were that the weapon system never had range and the pilot was orally given range with a 1σ accuracy of $\pm$ 3 n.mi at normal detection range. It was left to the intuition of the pilot as to when he should fire, based on his ability to sense the proper time, using only the instruments normally in his cockpit.

The pilot was told that he could use any of the information provided in the cockpit to accomplish his mission, but no clues were given him and he was not permitted to review his results until all runs were completed. Under these conditions he was able to successfully launch a missile with a probability of 36% or 43% of those runs which succeeded under normal conditions.

This capability is encouraging since several schemes of system simplification, which will be investigated later, should enhance the pilot's capability in this mode or ultimately negate the need for this mode. The major reason for failure in this mode was that the pilot fired early so that a simple operation on AEW range such as more accurate range or an increased data rate may be sufficient to increase his capability which would also be applicable to the other modes.

A fourth sequence of six hundred conversions was made in an "Attack While Search" (AWS) mode. This mode briefly is one in which the RIO controls the radar antenna to illuminate the target on the center bar of the three-bar Palmer scan in the Search mode. The pilot sees the target each time the antenna scans by and flies the aircraft such that the target is a fixed amount displaced from the center of the scope. When the target is displaced, in azimuth with the proper direction from the center of the scope, a corresponding lead angle is established. By attempting to fly a fixed lead angle under these conditions, the pilot makes his conversion utilizing a deviated pursuit course.

Operating under these limitations the pilot-RIO team was able to press the attack with a respectable success probability. The resulting probability of success varies with the fixed lead angle employed and the results obtained varied from 12% to 59.6%. It is felt that this capability can be

improved by optimizing the simulated system for this mode of operation. Any change along these lines would be in the way of system simplification. The major problem with this mode is the low data rate provided the pilot such that he has a lag in his control of the aircraft since he is accustomed to fly the system closed loop. One obvious method of increasing the data rate by a factor of 2 is to switch the radar to single bar scan after target detection.

This study to date, although all of the data have not been reduced and certain areas need further investigation, indicates that current system mechanization concepts are overly complex.

DETAILS OF SIMULATION

The simulation includes a cockpit mock-up with aircraft surface controls, the pilot and RIO's display, the aerodynamic simulation of the interceptor, and the kinematics relating the interceptor, the radar antenna, the target, and a space reference coordinate system. A block diagram showing these interrelationships is shown on Fig. 1. In planning this simulation, consideration of the program objectives determined the extent of component approximation. When indicated, simplifications of the problem are made to enhance reliability and to conserve computer capacity.

Method

The major piece of apparatus used in the study is a Reeves Electronic Analog Computer (REAC). The REAC is used to simulate:

a. F4H-1 aircraft.

b. Space geometry existing between the F4H-1 and a target.

c. Display information generated by the AN/APQ-72 radar and the AMCS Aero 1A Fire Control Computer.

In simulating the F4H-1, the basic three-dimensional aerodynamic equations of motion are modified to provide an aircraft which is linearized* in angle of attack and pitch. By imposing these restrictions on the up-down motion of the aircraft, the simulation is limited to co-altitude attacks in which the F4H-1 is allowed to make small perturbations about a fixed altitude. The target is mechanized as a point in space moving with constant speed in a straight line at a constant altitude. Three-dimensional space

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*for a linearized angle θ; $\sin\theta = \theta$, $\cos\theta = 1$

geometry between the F4H-1 and target is mechanized to obtain range and bearing, aircraft orientation angles and rates, antenna sightline angles and rates, and space range components.

The display information principally consists of steering errors, maximum and minimum range information, and allowable launch error. This information is presented to the F4H-1 pilot in the form of an oscilloscope display.

Mock-up

Used in conjunction with the simulated REAC equations is a cockpit mock-up which consists of:

a. A control stick by which the pilot transmits aileron and elevator commands to the aircraft. Also located on the control stick is the missile firing button.

b. Instrumentation panel supplying information on altitude and normal acceleration to the pilot.

c. A five inch oscilloscope on which the display information generated on the REAC is presented. Also on the oscilloscope is a horizon line which supplies roll and pitch information to the pilot.

d. A human pilot who is used to close the loop on the simulation. The pilot does not require any actual flight experience since previous studies have shown that, as far as the REAC results are concerned, the performance of a properly trained REAC pilot compares very favorably with that of an actual jet pilot.

e. Colored lights indicating R_{max}, Rmin, HOJ Mode and AOJ Mode.

Located in another part of the room from the cockpit is the radar operator mock-up which consists of:

a. A five inch oscilloscope displaying the identical information presented to the pilot.

b. A lock-on control handle which enables the radar operator to lock the F4H-1 antenna onto the target.

Display

As mentioned previously, the pilot and the radar operator receive identical display information through a pair of five inch oscilloscopes. Two types of presentations are available; namely:

a. search, and

b. track.

Search Presentation - Normal, HOJ and AOJ Modes

The search display consists of a horizon line, a target dot, an elevation strobe, and a pair of acquisition symbols as shown on Fig. 2. Approximate roll and pitch indication is supplied by the horizon line. The antenna elevation strobe and the azimuth component of the acquisition dot are space stabilized (unaffected by aircraft roll and pitch motions). The approximate position of the radar range gate is indicated by the acquisition symbols, two parallel bars, which are replaced by a range slash at the bottom of the bars when the lock-on button is pressed. The radar operator can position the acquisition symbols left or right, up or down by manipulating the lock-on control handle.

Search Presentation - Attack While Search Mode

The search presentation used in the AWS Mode is shown by Fig. 3. The antenna uses a three-bar Palmer scan in which the bars are separated by $3.75^\circ \pm 0.5^\circ$ vertically. The total horizontal scan is $\pm 15^\circ$ from scan center which can be oriented about the expected position of the target. The scan pattern is seen as a vertical noisy line sweeping back and forth across the scope face. The scope is intensity modulated as a function of target position as shown on Fig. 4.

Track Presentation - Normal and HOJ Modes

The track display, which replaces the search display after lock-on is achieved, is shown on Fig. 5. Pitch and roll information is still provided by the horizon line. Information on aircraft orientation is obtained by the steering error dot. The outer circle collapses to the R_{max} and R_{min} scribe marks as range approaches these values. Closing rate is indicated by the gap in the outer circle which rotates clockwise as closing rate increases. The inner circle represents the maximum allowable launch error for the missile. AI radar gimbal angle deflections are indicated by the elevation and azimuth strobes. The HOJ mode is distinguished visually from the Normal mode by the presence of the HOJ light.

Track Presentation - AOJ Mode

Since no range or range rate information is available for AOJ, the display is somewhat modified. The R_{max} and R_{min} lights do not function and the outer collapsing circle is blanked. The maximum allowable error circle is held at a constant radius of $8.5° \pm 2°$. A constant range of 3 nautical miles is inserted into the steering equations thereby causing the interceptor to fly an approximate deviated pursuit course at long ranges. The scope display is shown on Fig. 6.

Track Presentation - Attack While Search Mode

Since this mode is flown entirely in search there is no track presentation.

Switching From Search to Track

At the beginning of each attack, the display is in the search mode. At some time after the beginning of the attack, the target dot suddenly appears on the display indicating that AI radar detection range has been reached. At this time, in the Normal and HOJ modes, the radar operator positions the acquisition symbols over the target dot and depresses the lock-on button located on the lock-on control handle. By keeping the lock-on button depressed, the system locks-on (the display switches from search to track) when the following conditions are met:

a. Target dot is bracketed by acquisition symbols when lock-on button is initially depressed.

b. Ten seconds have elapsed since the target was detected.

The ten second time interlock is not a part of the actual weapon system, but is chosen to allow for possible lock-on difficulties in combat.

For the AOJ runs, the system automatically switches from search to track at AI radar detection range; thus, "locking-on" is not necessary. The system always remains in the search mode in the attack while search investigation.

Data Presentation

The data collected from the simulation is recorded in two different forms:

a. Brush recordings

b. X-Y plotter

The time histories of all the important simulation variables are recorded on four brush recorders having six channels apiece. A description of each variable is listed as it appears on the recorder.

Recorder 1 - Success or Failure Relationships

a. R - true range, nautical miles

The line of sight distance between the target and interceptor

R_{max} and R_{min} - first and second pips respectively, indicating the true maximum and minimum aerodynamic range of the missile as determined in the range interlock computer when the correct geometrical quantities are used as inputs.

b. $R_{display}$ - apparent range, nautical miles

The value of range presented on the display as determined by the systems memorized geometrical inputs

$R_{max_{display}}$ and $R_{min_{display}}$ - first and second pips respectively, indicating the maximum and minimum aerodynamic range of the missile as presented on display when the memorized geometrical quantities are used as inputs to the range interlock computer.

c. E_{max} - allowable launch error, degrees

The maximum allowable deviation in the error plane from the correct interceptor heading for successfully launching a missile when the correct geometrical quantities are used as inputs. The pips indicate the depressing and release of the firing button (pickle).

d. $E_{max_{display}}$ - apparent allowable launch error, degrees

The value of allowable launch error presented on the display as determined by the systems memorized geometrical inputs

e. E_R - radial error, degrees

The radial deviation from a correct interceptor heading as determined by the vector sum of the true azimuth and elevation steering errors when the correct geometrical quantities are used as inputs.

f. $E_{R_{display}}$ - apparent radial error, degrees

The value of radial error presented on the display based on the systems memorized geometrical inputs.

Recorder 2 - Space Geometry Relationships

a. $\dot{R}$ - range rate, feet per second

The closing velocity between the interceptor and target as determined in the radar range circuitry as if the target was being tracked in the Normal mode.

b. $\dot{R}_{display}$ - apparent range rate, feet per second

The value of range rate presented on the display as determined by the systems memorized geometrical quantities.

c. V_F - fighter velocity, feet per second

The true air speed of the interceptor.

d. λ_e - Elevation gimbal angle, degrees

The angle between the radar gimbal mechanical axis and the line of sight measured in the plane of the elevation gimbals.

e. λ_a - azimuth gimbal angle, degrees

The angle between the radar gimbal mechanical axis and the line of sight measured in the plane of the azimuth gimbals.

f. Ψ - aircraft heading angle in the horizontal plane, degrees

The fighter's Eulerian angle, wind axis in yaw, with reference to the target track.

Recorder 3 - Basic Aircraft Parameters

a. Θ - aircraft pitch angle, degrees

The angular displacement from the horizontal about the transverse axis (y axis) of the interceptor. Pitch angle is positive when the nose is up.

b. Φ - aircraft roll angle, degrees

The angular displacement from the horizontal about the longitudional axis (x axis) of the interceptor. Roll angle is positive when the right wing is down.

c. p - aircraft pitch rate, degrees per second

The angular rate of change about the transverse axis (y axis) of the interceptor.

d. Q - aircraft roll rate, degrees per second

The angular rate of change about the longitudional axis (x axis) of the interceptor.

e. r - aircraft yaw rate, degrees per second

The angular rate of change about the vertical axis (z axis) of the interceptor. Clockwise rotation is positive.

f. N - load factors, G's

The interceptors lift to weight (L/W) ratio

Recorder 4 - A Check on Recorder A

a. ϵ_{el} - elevation steering error, degrees

The deviation from the correct interceptor heading measured in the plane of the elevation gimbals.

b. ϵ_{az} - azimuth steering error, degrees

The deviation from the correct interceptor heading measured in the plane of the azimuth gimbals.

c. $\epsilon_{el_{display}}$ - apparent elevation steering error, degrees

The systems estimate of time elevation steering error based on memorized inputs.

d. $\epsilon_{az_{display}}$ - apparent azimuth steering error, degrees

The systems estimate of true azimuth steering error based on memorized inputs.

e. ω_j - elevation gimbal angle rate, degrees per second

The angular rate of the line of sight in the plane of the elevation gimbals.

f. ω_k - azimuth gimbal angle rate, degrees per second

The angular rate of the line of sight in the plane of the azimuth gimbals.

It can be seen from the above that each recorder has a specific function to perform. Recorder #1 is sufficient in itself to tell whether the attack is a success or a failure. Recorder #2 supplies information to check the space geometry relationships. Recorder #3 provides a check on basic aircraft parameters. Recorder #4 is useful as a check on Recorder #1 since its information may be used to compute R_{TRUE} and R_{DIS}. A sample brush recording is shown on Fig. 7.

In the Normal, HOJ and AOJ modes parallel computations of true and displayed range, range rate, allowable launch error, azimuth steering error, elevation steering error and total steering error are made. For the AWS mode, the "displayed" variables are undefined since the system remains in Search. In order to evaluate the AWS mode, the six quantities with the subscript (DIS) are replaced with the following:

A Space stabilized azimuth target position in search (degrees)

A′ Azimuth position of antenna center-of-scan in search (degrees)

E Space stabilized elevation target position in search (degrees)

E′ Antenna elevation strobe position in search (degrees)

To supplement the information obtained by the brush recordings, R_X and R_Y (the horizontal components of space range) are mechanized and fed to an X-Y plotting board. The result is a plot of range versus angle-off-the-nose in relative target coordinates. At the times when

R_{max} and R_{min} are equal to range, they produce output pulses which trigger differentiator circuits producing pips in the Y channel of the plotter. Thus, the relative plots also show the range and angle-off-the-nose at R_{max} and R_{min} for each run.

CRITERIA FOR SUCCESS

For an intercept run to be a success in actual practice, the missile must be launched within an allowable launch error and within its aerodynamic range capability. This same success criteria was employed in reducing the data resulting from the simulation effort. For the run to be scored as a success the actual launch error at the time the launch button was pressed (or when interlock permits missile launch) must be equal to or less than the allowable launch error, and the actual range must be less than the maximum aerodynamic range of the missile (R_{max}) and greater than the minimum aerodynamic range (R_{min}). The allowable launch error was obtained from the following equation:

$$E_{max} = \lambda + K_3 \frac{R}{R_{max}} \left| V_C - K_1 V_F \right| - K_2 \left| V_C - K_1 V_F \right|$$

E_{max} is limited to 15° or less

$\lambda = 3°$

$K_1 = 0.75$

$K_2 = 0.0054°$ per foot per second

$K_3 = 0.015$

V_C = closing velocity

V_F = interceptor velocity

The aerodynamic ranges were obtained using the calculated velocities from the geometry for the particular course of interest.

FIRE CONTROL INVESTIGATION

The interceptor is vectored in a horizontal plane along a pure collision course to the point of AI radar detection at an angle τ_0 off the nose of the target. The locations of the interceptor course at detection

are dispersed in a horizontal plane in accord with the normal probability distributions of vectoring errors and detection range with standard deviations of 3 nautical miles and 3.6 nautical miles, respectively (Refs. 1 and 2).

The area in which the possible locations of the interceptor at detection are dispersed is divided into 8 rays 2 nautical miles by 12 nautical miles parallel to the ideal vectoring ray. Each ray is given a statistical weight due to vectoring error distribution. In addition, each ray is divided into 6 blocks 2 nautical miles by 2 nautical miles weighted according to range distribution as shown on Fig. 8.

At lock-on the interceptor pilot maneuvers his aircraft so as to drive to zero any steering errors present. The method of maneuvering is dependent on the type of track mode employed; however, in all cases the interceptor must not exceed 3g's normal acceleration (Ref. 3). All attack modes considered are identical prior to the point of AI radar detection. The attack mode is classified according to the method of operation after detection of the target.

Normal Attack Mode

The purpose of this phase of the investigation was to establish AMCS capability under selected realistic tactical conditions. The results obtained were used as a training medium and as a reference level for determining success in following phases.

In the simulation of the Normal Attack mode there is no enemy countermeasures. The radar operator is prevented by a 10 second timer from completing lock-on sooner than ten seconds after detection. This is considered to be a realistic delay for the detection to lock-on process (Ref. 3). After lock-on, the search display is replaced by the track display which is driven by the airborne computer using the true range and range rate. The pilot then converts to a true lead-pursuit course by flying the steering error dot to the center of the scope and keeping it there. The missiles are launched by depressing the missile launch button on or after the presentation of the R_{max} signal and before the presentation of the R_{min} signal.

Conditions

In this phase of the investigation all attacks were conducted under co-altitude conditions at 50,000 ft altitude. The interceptor velocity (V_F) was V_{max} at the start of the run and the target velocity (V_T) = M 2.0.

The interceptor was vectored on a pure collision course. After AI radar lock-on the aircraft flies the normal lead pursuit course. Two target aspect angles (τ_o) were investigated, 15° and 30° (Fig. 9). The boxes in the probability grid from which intercept runs were made are as follows:

$\tau_o = 15°$ A-4, B-4, D-3, E-2, F-5

$\tau_o = 30°$ B-3, D-4, E-2, F-5, G-4

Twenty runs minimum (10 right and 10 left) were made in a random fashion from each of the selected boxes in the probability grid.

The interceptor aircraft employed is the F4H-1. The performance of this aircraft, as simulated, is described in detail in Ref. 4. The missile characteristics used in this simulation are those of the Sparrow III6a and are described in detail in Ref. 5. Some of the pertinent factors are as follows:

$$V_o = 1000 \left[1 + 0.3 \left(1 - \frac{P}{P_{SL}}\right)\right]$$

V_o = average velocity above launch velocity

$$R_{max} = R_{1(h)} + T_1 (V_C - V_F)$$

$$R_{1(h)} = -26.560 \log \frac{P}{P_{SL}} + 11000$$

T_1 = 11 seconds for $V_C > V_F$

$$T_1 = -5.95 \log \frac{P}{P_{SL}} + 4.4 \text{ for } V_C < V_F$$

$$R_{min} = R_{2(h)} + T_2 V_C$$

$$R_{2(h)} = -3442 \log \frac{P}{P_{SL}} + 2200 \text{ ft from 0 to 30,000 ft altitude}$$

$$R_{2(h)} = -10.480 \log \frac{P}{P_{SL}} - 1480 \text{ ft from 30,000 ft to 70,000 ft alt}$$

P = pressure at altitude

P_{SL} = pressure at sea level

T_2 = 4.3 seconds

$$\epsilon_{az} \text{ (az steering error)} = \frac{\left[\frac{R\dot{a}_K}{57.3} - V_o \sin \lambda a\right] 57.3}{3400}$$

$$\epsilon_{el}(\text{el steering error}) = \frac{\left[\frac{R\omega_j}{57.3} - V_o \text{ Cos } \lambda a \text{ Sin } \lambda e\right] 57.3 - 0.48\alpha}{3400}$$

α = aerodynamic angle of attack

ω_k = line of sight rotation rate in azimuth

ω_j = line of sight rotation rate in elevation

R = fighter to target range

λa = azimuth gimbal angle

λe = elevation gimbal angle

English bias is assumed correct for all launching stations. Missile gimbal limits are $\pm 46^\circ$ in azimuth and elevation.

The target is of B-47 radar size. The AI radar is as defined in Ref. 6. Its high probability detection capability is 19 nautical miles head-on against the B-47 size target closing at M 3.6. The radar gimbal limits are $\pm 57^\circ$.

Results

The initial conditions for the two sets of runs used in this phase of the investigation are given on Tables 1 and 2. One hundred runs were made for conditions given on each of these tables (total of two hundred runs). The first column on these tables gives the run numbers 1 through 10, initial aspect angle, whether the run was initiated from the right or left-hand side of the target, and the box in the probability grid. For example 1-15L-A4 is run number 1, $\tau_o = 15^\circ$, left-hand side of target and box A4. The second column gives the range at which the run started (R_o). The third column gives the initial aircraft heading angle (Ψ_o). The actual detection range (R_d) is given in the fourth column. The initial elevation (λe_o) and azimuth (λa_o) gimbal angles are given in the last two columns.

The results of the simulation of these two hundred runs are given on Tables 3 and 4. The number of successes for each ten runs are given. The reasons for the failures are listed. For the group given on Table 3 there were 96 complete runs, 85 successes, 9 failures due to too large a steering error, 2 failures due to failure to fire when permissible and 4 incomplete

runs. Thus there were 96 valid runs. This represents $\frac{85}{96}$ or 88.6% success. The second group of runs yielded 79% probability of success. These runs will be used as the standard for measuring the capability of system operation in degraded or countermeasures environment. The probabilities associated with each box in the detection grid are given on Fig. 9.

Evaluation of the Normal mode simulation results are given on Tables 3.1 through 4.5. The first column gives the run number and consists of runs 1 to 200. The code given in the second column is the same as described previously. The third column tells whether launch occurs between R_{max} and R_{min}. The allowable launch error (E_{max}) and the actual radial error (E_R) are given at the firing point and at a point 2 seconds after firing. Two seconds is the time elapsed from "pickel" to the instant that the missile leaves the aircraft. The last two columns list pertinent remarks and describe whether the run was a success or failure.

These results are obtained as follows: The E_{max} brush recordings for each run is first inspected to determine whether a missile has been fired during the run. If a firing does occur, the next step is to determine whether the firing occurs between R_{max} and R_{min}. This is easily done by observing the range channel of the brush recording (containing R_{max} and R_{min} indications) which is located next to the E_{max} channel as shown on Fig. 7. If the missile firing does occur between R_{max} and R_{min}, then the run will be considered a success if the maximum allowable launch error (E_{max}) is greater than or equal to the true radial steering error (E_R) for approximately 2 seconds after firing. Thus, the values of E_{max}* and E_R are tabulated at time-of-fire and also time-of-fire plus 2 seconds. If at both evaluation points $E_{max} \geq E_R$, then the run is recorded as a success. However, if the condition $E_{max} \geq E_R$ only holds true for one of the two evaluation points, the run is considered marginally successful and is so indicated. If $E_R > E_{max}$ for both evaluation points, then the missile firing is assumed to be an error in pilot judgement and the run is labeled a failure.

If missile firing occurs before R_{max} is reached, it does not necessarily imply failure since there is an interlock present in the system which will not allow the missile to be fired until R_{max} is reached. In such a case, the evaluation points do not begin with time-of-fire. The first evaluation is taken at R_{max} and the second evaluation at two seconds after R_{max} has been attained. Determination of success or failure is then undertaken exactly as described above.

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*The recorded E_{max} is exactly that determined from the E_{max} equation and can assume any positive value. However, the E_{max} which the pilot observes on his scope is limited to a maximum of 15°. Thus, when reading the results, values of E_{max} greater than 15° should be interpreted as being equal to 15°.

If missile firing occurs after R_{min} is attained the run is considered a failure with no additional evaluation necessary.

If there is no missile firing at any time during the run, E_{max} and E_R are tabulated at R_{max} and also at R_{max} plus 2 seconds. If E_R is always greater than E_{max} in this region, the run is a failure due to excessive steering errors. If E_R is approximately equal to E_{max} in this region, the run is considered marginally successful, but it is still recorded as a failure. If $E_{max} > E_R$ in this region, the run is also labeled a failure even though the pilot could have fired successfully. Runs of this type are indicated by inserting the remark "could have fired" in the REMARKS column of the results.

One other evaluation which has not been previously mentioned is the "Incomplete" run. An incomplete run is one in which one of the initial conditions of the run had been inserted incorrectly but was not discovered until the data was analyzed. These runs are not considered in an evaluation of results.

HOJ Attack Mode

The purpose of this phase of the investigation was to determine the capability for solving the fire control problem in the presence of countermeasures using the current HOJ mechanization. The results will be compared with those of the Normal mode to determine relative capability. In addition, the results will be examined to determine if improvements can be made in this HOJ mechanization.

Conditions

In this phase of the study, the initial conditions are the same as those described in the preceding section for the Normal mode except:

a. Jammed environment.

b. It is assumed that the radar has locked on and the computer has settled on a solution before countermeasures start.

c. The countermeasures continues throughout the run at a level sufficient to keep the system in HOJ.

d. Continuous angle information is available.

e. The lead pursuit course computation is based on the last known range and range rate. The effect of integrator drift on the computation of range in the HOJ mode is simulated by adding $\pm$ 2.7t + 3 ft per second to the last known value of range rate, where t is the time in seconds after the HOJ mode is initiated.

f. The HOJ track presentation is similar to the Normal presentation except that a light signals the existence of the HOJ mode. The steering error is reduced by plying the steering error dot to the center of the scope as in the Normal mode. However, due to the degraded range information, zeroing of the steering error dot will not reduce the true steering error to zero.

Results

The initial conditions for the two sets of runs used in the HOJ phase of the investigation are the same as those used in the Normal mode and are given on Tables 1 and 2.

A summary of the results of the HOJ mode for the two hundred simulation runs are given on Tables 5 and 6.

From Table 5, the overall probability of success for Runs 201-300 is 74% and from Table 6, the overall probability of success for Runs 301-400 is 72%. Comparable results given previously for the Normal mode of operation were 88.6% and 79%. Thus, for those runs which succeeded in the Normal mode of operation $\frac{74}{88.6} = 83.5\%$ and $\frac{72}{79} = 91\%$ succeeded in the HOJ mode. These results are very encouraging and indicate that absolute and continuous range information may not be essential to successful missile launch.

As in the Normal mode, the cases which most degraded the performance are Cases 1 and 10. Case 1 resulted in zero successes per 20 trials and Case 10 resulted in 8 successes per 20 trials. The performance of Case 10 was improved from that shown in the Normal mode due to using a larger initial range beginning with Run 237.

Case 6, which was very successful in the Normal mode, was successful for only four trials in 20 attempts in the HOJ mode. The reason for failure in every instance was a tendency to fire before the true maximum firing range was attained. This phenomenon will probably appear for all further high angle-off courses in subsequent reports. The course begins at 40° off the nose of the trarget and is forced back towards the tail due

to geometry. The value of range rate thus becomes less negative as the course progresses and the actual range closes more slowly than is indicated by the constant range rate fed to the range integrator. Thus the "in-range" light is triggered when the actual range is still too great for a successful launch.

An evaluation for the 200 HOJ runs is given on Tables 5.1 through 6.5. The differences in these tables and those described previously for the Normal mode are as follows:

a. Column 3 gives the polarity of the drift in the integrator associated with range rate computation.

b. Both true maximum allowable launch error and maximum allowable error as computed in HOJ are recorded.

c. The true radial error and the radial error as computed in HOJ are given.

The criteria for success is the same as that employed in the Normal mode except launch must occur between R_{max} and R_{min}. In the Normal mode, pressing the launch button before R_{max} is reached will not result in a failure since an interlock prevents launch until R_{max} is reached. This is not the case in the HOJ mode. If the missile firing occurs more than one second before R_{max} is reached, the run is a failure since the interlock is disabled. For early firings of less than one second, the run is termed a marginal failure or an outright failure depending on the values of E_{max} and E_R at time-of-fire.

AOJ Attack Mode

The purpose of this phase of the investigation was to determine the capability for solving the fire control problem in the presence of countermeasures using the current AOJ mechanization. The results will be compared with those obtained previously for the Normal mode and HOJ mode of attack. An examination will be made of the results to see if improvements can be made in the mechanization or in the attack doctrine.

Conditions

In this phase of the study the initial conditions (conditions at AI detection) are the same as those given previously for the Normal mode of operation except:

a. Range information is never available to the AI radar, (angle lock-on only) countermeasures exists throughout the run.

b. Continuous angle information is available.

c. Initial range input at the start of the fire control problem is obtained from Airborne Early Warning (AEW) at normal AI radar detection range. The AEW range accuracy is such that $1\sigma = \pm 3$ nautical miles.

In the AOJ mode, lock-on and the initial determination of range and range rate is assumed denied by countermeasures. Thus, the AOJ mode light and the AOJ track display are presented at detection range in this simulation. Since a constant range of 3 nautical miles is inserted into the steering equations, the course is an approximate deviated pursuit course (lead pursuit dictated by a fixed range input) at long ranges when ω_j and ω_k are small. The R term in the ϵ_{el} and ϵ_{az} equations will be 3 ± 0.5 nmi. The firing interlocks are shorted. The allowable steering error circle is fixed at $8.5^\circ \pm 2^\circ$. No range to impact is presented. The range to go circle is blanked. The R_{max} circle is removed and there is no range rate slash.

As stated previously, the range information transmitted from AEW to the interceptor has a distribution such that $1\sigma = \pm 3$ nautical miles. In the simulation a set of random numbers were generated and used in presenting range information to the computer thus giving this distribution.

Armed with this value of range, and knowing his interceptor speed and the approximate target speed, the pilot proceeds to fly the course and try to decide when he is within the missile firing range.

When the pilot feels that he is within the firing range, he depresses the firing button and continues to fly the course. If, after 10 seconds from firing the missile, the pilot is still able to fly the course without experiencing large accelerations, he accepts this condition as an indication that he has either fired too early or that he is flying a head-on attack. If he chooses to assume that he has fired too early, he can exercise his option of firing a second missile. If only one missile is fired in a particular run, the run is evaluated as described previously. However, if the pilot fires early and, realizing his mistake, fires a second time while in the missile launch zone, the run is labeled a success.

Results

The initial conditions for the two sets of runs used in the AOJ phase are the same as those given for the Normal attack phase on Tables 1 and 2.

A summary of the results of the AOJ mode for the two hundred simulation runs are given on Tables 7 and 8.

From Table 7, the overall probability of success for Runs 401-500 is 36% and from Table 8, the overall probability of success for Runs 501-600 is 37%. This compares to 88.6 and 79% success for the Normal mode of operation.

It was found that the method of using the range information obtained from CIC at time of detection is practically worthless to the interceptor pilot for the following reasons. The pilot is supposed to calculate the approximate time-to-go by assuming a head-on attack, thus

where t_g = time-to-go

R_{CIC} = the range supplied by CIC (which may be in error by ± 6 nautical miles)

R_{max} = maximum launch range of missile ($\approx$ 6.5 nautical miles)

V_T = target speed

V_F = interceptor speed

$V_T + V_F$ = 4000 ft per second $\approx \frac{2}{3}$ nautical miles per second

From the above one can see that a quick mental calculation of time-to-go is obtained by subtracting 6.5 from R_{CIC}, then multiplying the result by 1.5. Once t_g is known, the pilot can mentally count off t_g seconds from detection and then fire the missile. The problem which arises is that both the mental calculation and the count off are to start at detection. The pilot must, therefore, do both simultaneously while flying the aircraft. Finally, even if the pilot does the job perfectly, the ± 6 nautical miles possible error in R_{CIC} indicates that the t_g calculated may be in error by ± 10 seconds.

The entire procedure became so confusing after approximately 50 runs were made, that the pilot began to fire by intuition with no degradation in results. After settling the initial tracking error, the pilot flew the course until normal accelerations of 2 to 2.5 g's were required. At this time he would fire and continue to fly the course. If, after 10 seconds from firing, the pilot was still able to fly the course without experiencing large accelerations, he accepted this condition as an indication that he had either fired too early or that he was flying a head-on attack. If he chose to assume that he had fired too early, he would fire another missile at this time.

An evaluation of the results for the AOJ mode are presented on Tables 7.1-8.5 and consist of Runs 401-600. These results are presented in a slightly different manner than those of the Normal and HOJ modes, the differences being that there is no tabulation of E_{max} and E_R for time-of-fire plus two seconds. However, values of E_{max} and E_R are tabulated at R_{max} and R_{min} for each run. These are included since, having no range information, the pilot is liable to fire at any time and if he does fire while far from the missile launch zone, there would be no information available concerning steering errors and allowable errors in the missile launch zone. When this information is available, attacks which are failures due to early firings are still useful in that a measure can be made of potential success had the pilot fired in the proper zone.

Attack-While-Search Mode

The purpose of this phase of the investigation was to determine system capability for solving the fire control problem in the presence of anticipated countermeasures techniques by staying in the Search mode of the AI radar.

Conditions

In this phase of the study the initial conditions are the same as those given previously for the Normal mode of operation except in this mode lock-on is not attempted and the search display remains on in narrow-scan throughout the attack. The antenna uses a 3-bar Palmer scan. The bars are separated by $3.75^\circ \pm 0.5^\circ$ vertically, and extend $\pm 15^\circ$ from center-of-scan in azimuth when in narrow-scan. The overall effective narrow-scan pattern is approximately 30° by 12°, and the center-of-scan is positioned horizontally and vertically by means of the radar operator's control handle. The radar operator positions the antenna in elevation by regarding the intensity and frequency of appearance of the target dot. Target intensity varies as a function of the position in the scanned beam.

The scan pattern and the scope display are space-stabilized, with the center of the scope representing dead-ahead along the RGMA longitudinal axis. The pilot obtains the target azimuth angle from the B scope display, and the elevation angle from the antenna elevation marker. Using this angular information he attempts to fly a deviated pursuit course. Therefore, instead of zeroing a steering error dot, the pilot tries to keep the target dot positioned on some predetermined constant azimuth antenna angle.

The signal-to-noise ratio was varied according to the probability of detection in the specific cases and continued to vary as a function of range. The attack course flown was a deviated pursuit course with constant lead angles of 10°, 18° and 25°. Two hundred runs were made for each of these lead angles.

Results

The initial conditions for the AWS investigation are the same as those given for the normal attack phase on Tables 2 and 3.

Tables 9 through 14 give the results for the AWS investigation. The percent of successes are given at the bottom of each of these tables. In addition to determining the percentage of successes, the potential successes are also calculated. If, on a particular run, $E_{max} \geq E_R$ at $R_{min} \leq R_{max}$ then the run is termed a potential success even though it may have been aborted due to an early or late firing. A condensation of the results are as follows:

Run #	T_o	Lead Angle	% Actual Successes	% Potential Successes
601-700	↑	10°	53	68
701-800	15°	10°	31	53
801-900	or	18°	59.6	72.8
901-1000	30°	18°	22	49
1001-1100		25°	39	53
1101-1200	↓	25°	12	33

Pertinent data related to each of these AWS runs are given on Tables 9.1 through 14.5.

The only difference between Runs 601-700 and 701-800 is that every right-handed attack in Runs 601-700 becomes a left-handed attack in Runs 701-800 and vice versa. However, the percentage of successes and potential

successes are significantly higher for Runs 601-700 than for Runs 701-800. This same phenomenon appears when Runs 801-900 are compared with Runs 901-1000. The lower numbered sets yielded the highest probabilities of success in each case.

The explanation for these differences is that Runs 701-800, 901-1000, and 1101-1200 were flown before the corresponding lower numbered runs in each set and the differences in probability of success reflect the learning process of pilot and radar operator, neither of whom had flown this type of attack previously.

Summary of Results

A condensed summary of the results obtained for all phases of the investigation is given on Table 15. The combined results (probability of success) for all runs associated with each mode is given in Column 2. For the Normal mode of operation this probability of success is 83.7%. Using the Normal mode results as a standard the results given in Column 3 are obtained. For example, referring to Column 2, opposite HOJ, we see that the actual probability of success is 73%. However, under the best conditions (Normal mode) only 87.2% success was available. Thus the HOJ mode is 87% as good as the best mode (Normal) of operation. Comparable results are given for the other modes investigated. The high level of success achieved for all modes is encouraging. In the AWS investigation 10° lead angles yielded the highest probability of success (50.2% of the best available).

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study effort is to establish the minimum fire control requirements to successfully launch an air to air missile. Many people familiar with and qualified in the field of airborne fire control systems believe that these systems have, through an evolutionary process, become overly complex in terms of the desired tactical capability. With the advent of missiles as a weapon, it would seem logical that the tolerances of angle, range and computer parameters could be increased beyond that required for the predecessor gun and rocket systems and still provide a satisfactory solution to the problem. Such has not been the case, since the equipment designers tend to provide as high a degree of accuracy as the state-of-the-art will allow.

In the preceding sections, data has been presented which describes the tactical capability of the F4H-1 system when used in the various mechanized modes of operation. The results for each mode have been compared and trends

indicated as the input information accuracy is progressively decreased from that available in the Normal mode of operation, to HOJ mode, to AOJ mode and finally AWS mode. It is now important to examine in detail the data recorded for each mode of operation to determine if simple fixes, change in doctrine or pilot-operator judgement can be employed to enhance the operational capability of the system in degraded modes of operation. This in turn will serve as clues to where system simplification could result and still permit the development and employment of a tactically useful system. While the study results presented in this report are preliminary in nature they will provide guidelines for future investigation.

It would be premature to postulate the true requirements for a system to control the launching of an air to air missile at this time. It can be stated that recommendations for simplifying current systems will be forthcoming. Several of these recommendations are being programmed into this study effort for verification prior to final system evaluation. Some of these recommendations and observations are as follows:

a. From the comparison of the results of the Normal mode and the HOJ mode, it appears that a simple fixed analog of range rate, in a typical lead pursuit course, operating on memorized range would provide the system adequate range and range rate information. The effects of interceptor slow down and changing geometry, in a lead pursuit course, has a much greater effect on range rate than the errors generated due to open loop operation of the ranging system as shown on Fig. 10. Therefore, with range rate corrected for the effects of reduced interceptor velocity and geometric slow down, the sensitivity of range and range rate accuracy can be defined. Another output would be the measure of absolute range rate accuracy requirements as pertains to the needs of the weapon. As an example, the Sparrow III seeker requires range rate to a given accuracy to set the doppler speed gate in the narrow sweep.

b. Range and range rate are inputs provided the interceptor from AEW or other CIC sources. These should be utilized to the utmost. Such information has associated errors predicted to be $1\sigma = \pm 3$ miles in range and rates of acceptable accuracy. It is the intent of this study to establish by means of the F4H-1 simulation, the capability of using this type range and range rate data as inputs for computed solutions. Airborne missile control systems, as presently configured, have a requirement to provide acceptable range information in the presence of enemy countermeasures. Such ranging schemes are applicable to these conditions and the AWS mode.

Several variations of utilizing the AEW or CIC range and range rate information are contemplated since one has to assume that the data rate to the interceptor may be degradated by either malfunction or enemy tactics.

One advantage the interceptor has, when the enemy initiates countermeasures prior to normal detection ranges, is longer detection ranges. The interceptor team may choose not to lock-up on the target at these longer ranges since they have to resolve a particular target in the case of multiple targets and in many cases the probability of successful conversion is enhanced by delaying the initial maneuver.

c. If the range accuracy requirements can be reduced, the necessity for many of the elaborate range tracking circuits, multipulse width transmitters and receivers need to be re-evaluated. It is conceivable that a single pulse width will be sufficient, thus negating the requirement for wide band, back bias receivers, etc. Such a statement may be premature, but further investigation of this area will be made.

d. The AWS investigation was encouraging and indicates that limitation in this mode is the data rate of target information. In the current mechanization, the scan pattern (30° azimuth and 12° elevation) is too large and the antenna does not illuminate the target often enough. A reduction in size of the scan pattern after detection, to some optimum size, would increase the data rate and ease the RIO's problem of positioning the antenna on the target. Since the RIO views a "B" scope (vertical depicts range, horizontal depicts antenna azimuth position) presenting it will be necessary to improve the method of indicating the antenna elevation position. Such a mechanization change will be made on the simulator and evaluated as to its sufficiency in satisfying the system requirements. The CW illumination of the target and the rear missile antenna after launch will be one of the parameters considered in optimizing this scan pattern. High on the agenda, however, is to determine if it is mandatory to continuously illuminate the target with CW after launch and if not the duty cycle that can be tolerated.

This type of operation is considered to be the goal in system simplification, since the equipment complexity would be reduced and the AMCS would not be susceptible to most enemy countermeasures.

e. From the results of the efforts to date, several trends have been established where certain parameters vary in a pattern that could be a clue to the interceptor team for solving the problem. Several of these trends, listed as follows, will be investigated and further developed by additional simulation.

1. The range rate variation seems to fall into a pattern which lends itself to approximation as mentioned previously and thereby should provide a voltage that is an indication of range. Apparant range rate will more closely approximate true range rate in the simulation. The data from additional conversions will be evaluated to establish, when the approximated range rate drops to a given percentage of the initial range rate, that true range is within the firing zone.

2. Roll angle appears to follow a pattern and the sign of the roll angle adds sense or polarity to this pattern. It is conceived that, given knowledge of the roll angle characteristics, the pilot could fly a deviated pursuit course until his roll angle reached a given value at which time he would modify his roll angle, in the direction of problem solution, to establish a known displacement. With a known displacement in roll angle, other quantities, such as rate of change of line of sight, etc., will vary such as to provide an estimate of range.

3. It has been noted in the simulation to date that roll angle and acceleration stabilize near the maximum.

4. The elevation and azimuth gimbal space rates of the line-of-sight tend to stabilize at some low constant value for runs experiencing essentially zero steering errors.

5. The success of the HOJ mode may be improved to that of the Normal mode, with a simple interlock time delay limiting the release of the missile before true R_{max}. This time delay would function for approximately 2.0 seconds after indicated R_{max} appears on the scope before the missile would be released. A cursory evaluation of 200 runs in the HOJ mode indicates that the steering errors at the time of missile launch would also be improved by a time delay.

f. In view of the fact that several areas of system improvement through simplification have been spotlighted, it is strongly recommended that this investigation of the minimum fire control requirements be continued by the Navy.

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J. Ryon I. Bellavin C. Loughmiller R. Aberg	NRL (Weapons System Section)
A. Zamanakas	NRL

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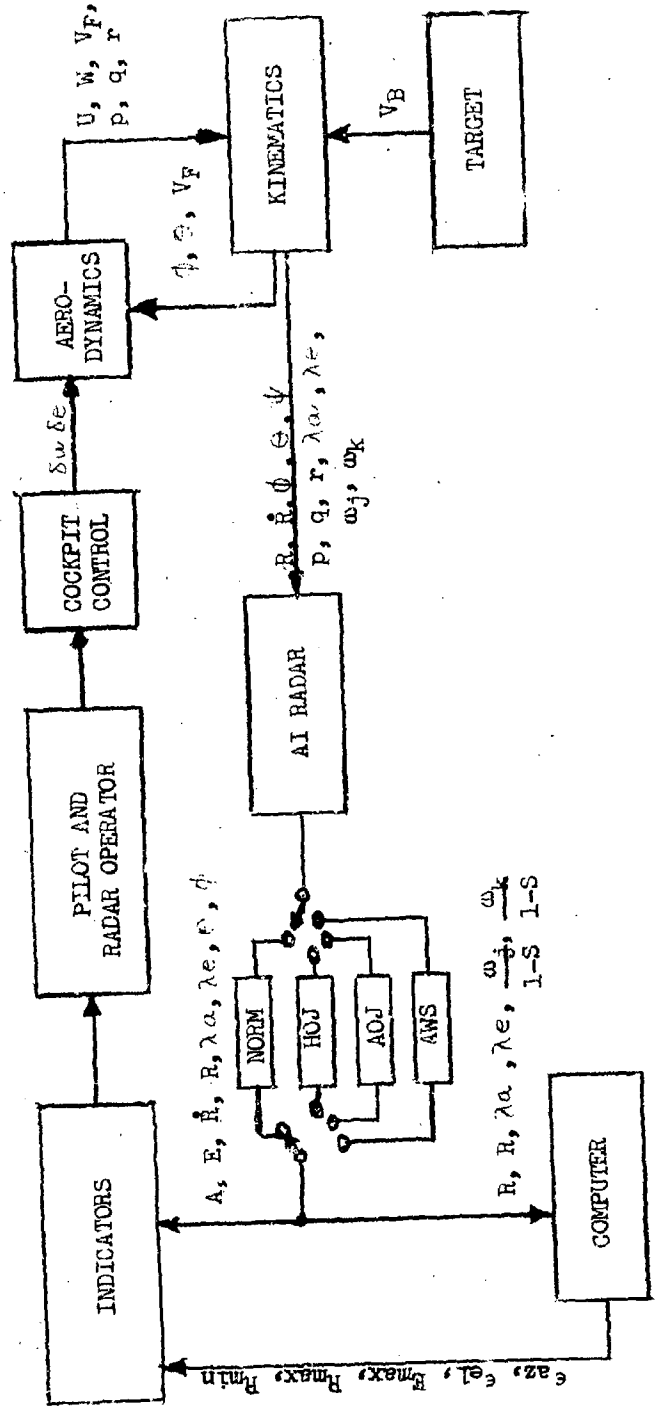
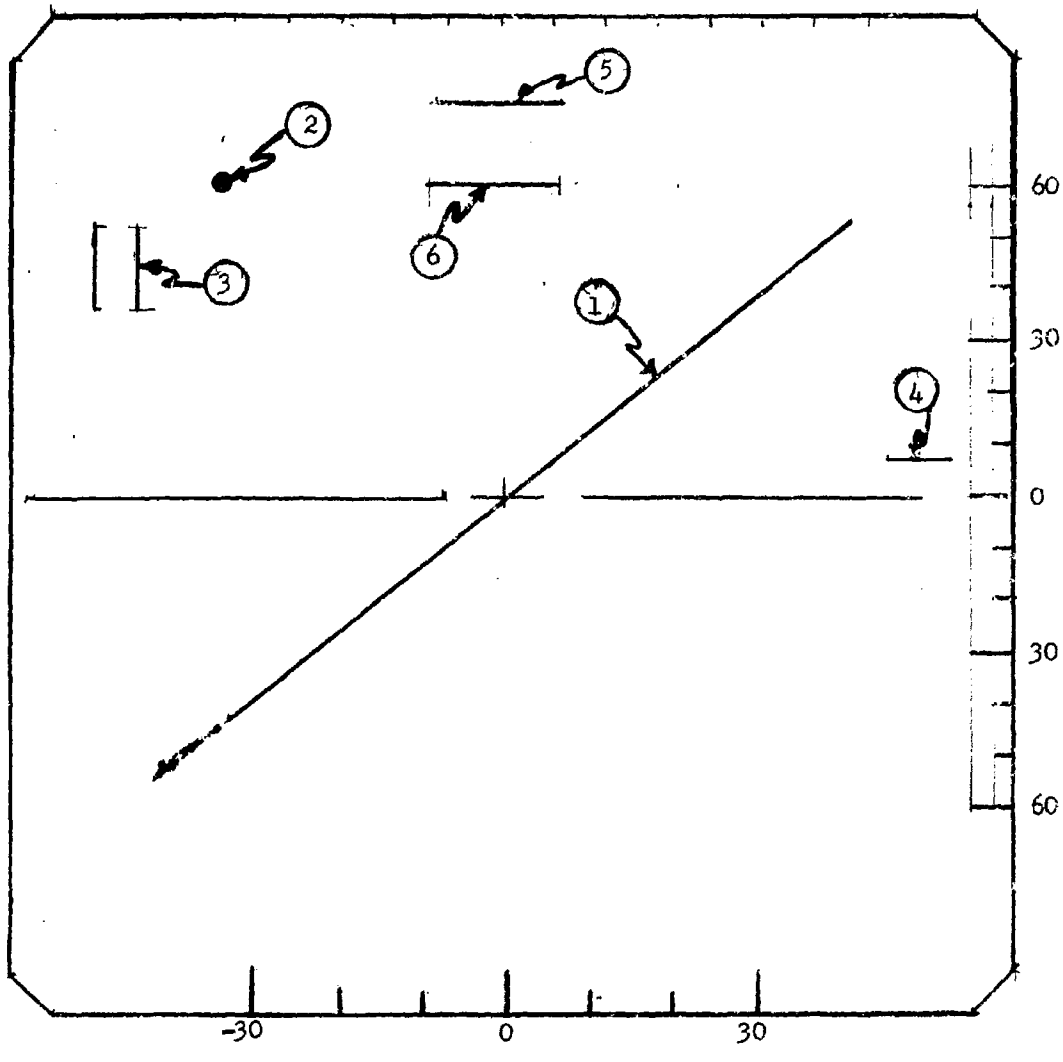
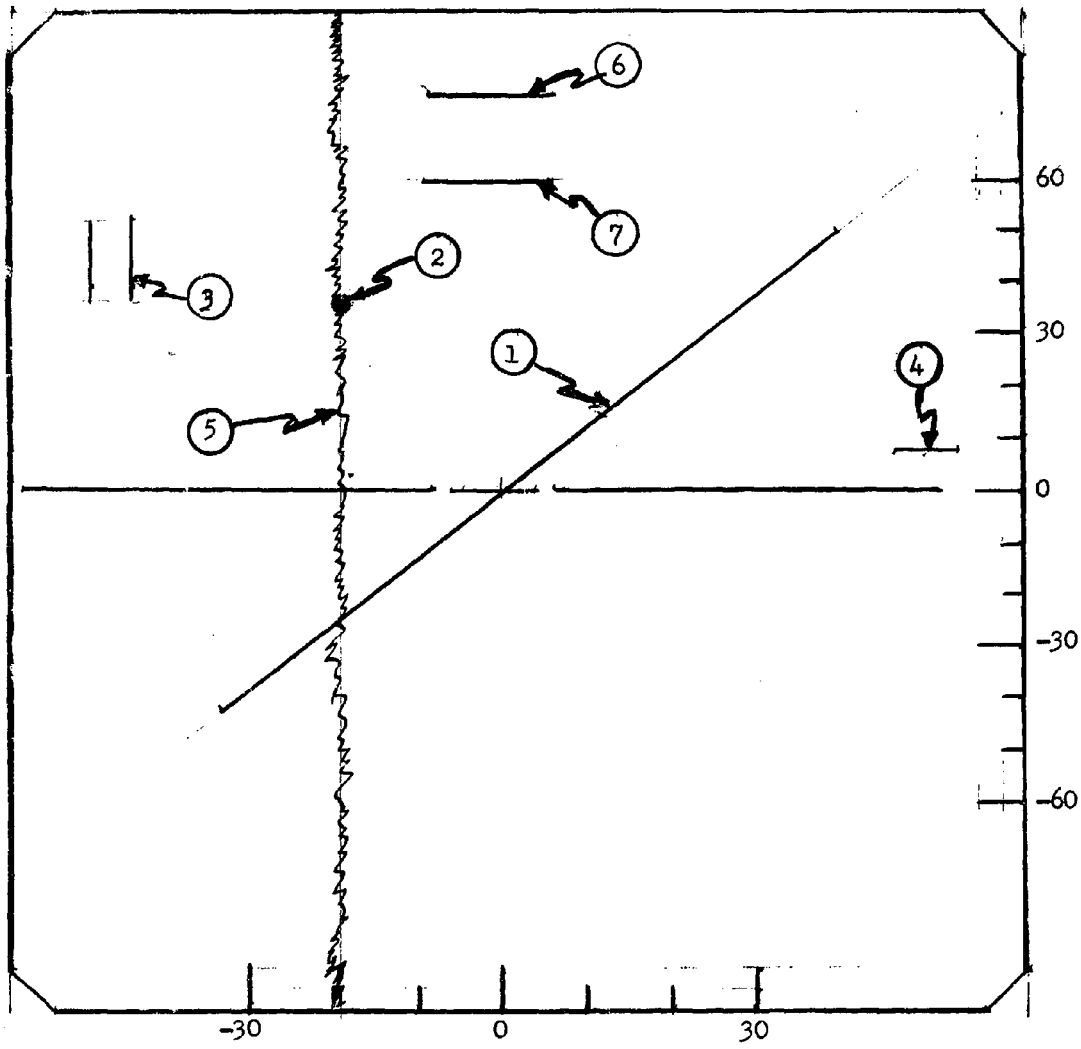


Figure 1 Block Diagram of Simulation



1. Roll Bar
2. Target Dot
3. Acquisition Symbol
4. Target Elevation
5. R_{max} Scribe Mark
6. R_{min} Scribe Mark

Figure 2 Search Display-Normal, HOJ and AOJ Modes



1. Roll Bar
2. Target Dot
3. Acquisition Symbol
4. Target Elevation
5. Anterna Azimuth Sweep
6. R_{max} Scribe Mark
7. R_{min} Scribe Mark

Figure 3 Search Display - AWS Mode

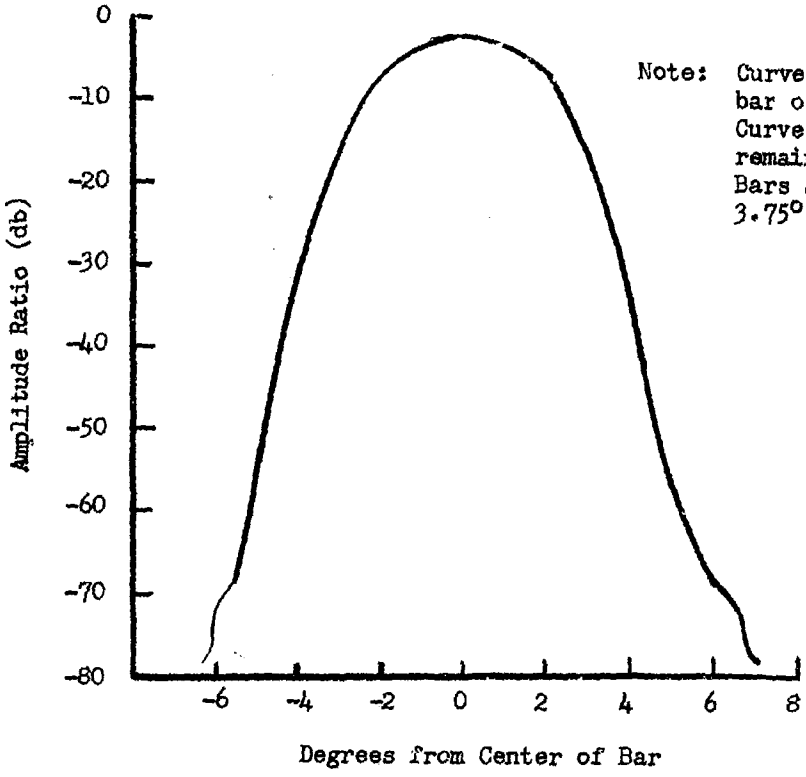
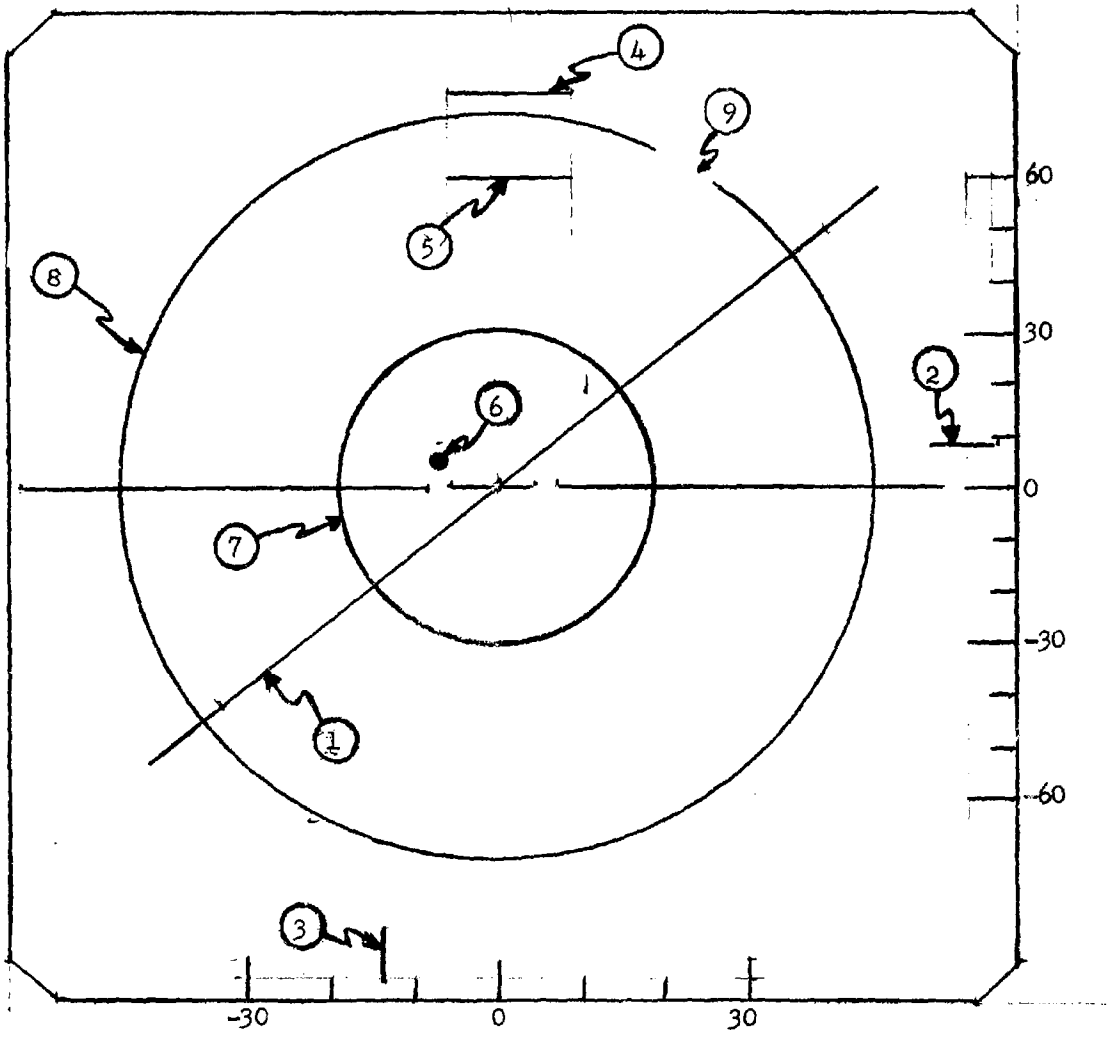
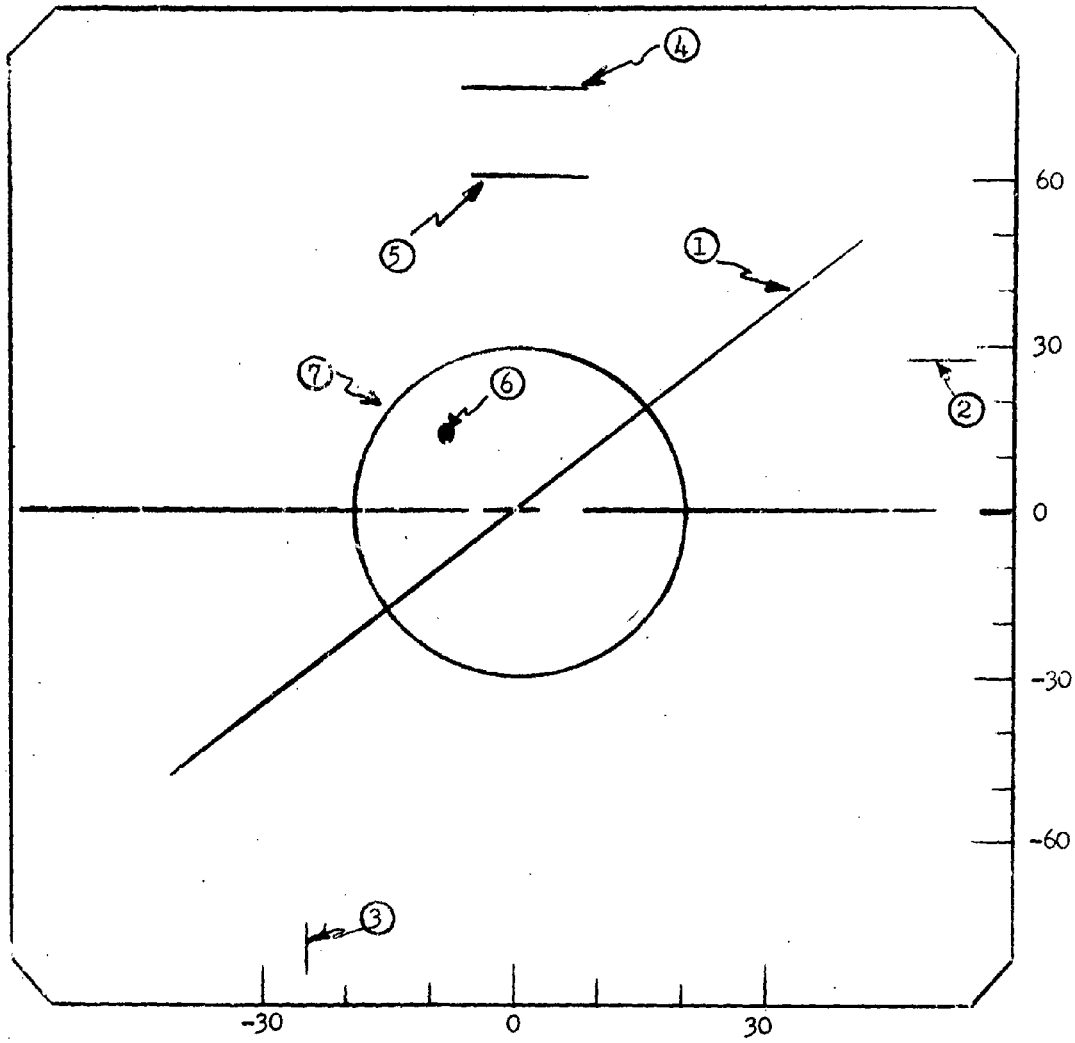


Figure 4 Scope Intensity as a Function of Distance from Center of Bar, Elevation Channel.



1. Roll Bar
2. Elevation Gimbal Angle
3. Azimuth Gimbal Angle
4. R_{max} Scribe Mark
5. R_{min} Scribe Mark
6. Error Dot
7. Maximum Error Circle
8. R_{max} - R_{min} Circle
9. Range Rate Gap

Figure 5 Track Display - Normal & HOJ Modes



1. Roll Bar
2. Elevation Gimbal Angle
3. Azimuth Gimbal Angle
4. R_{max} Scribe Mark
5. R_{min} Scribe Mark
6. Error Dot
7. Maximum Error Circle - Constant diameter = 8.5°

Figure 6 Track Display - AOJ Mode

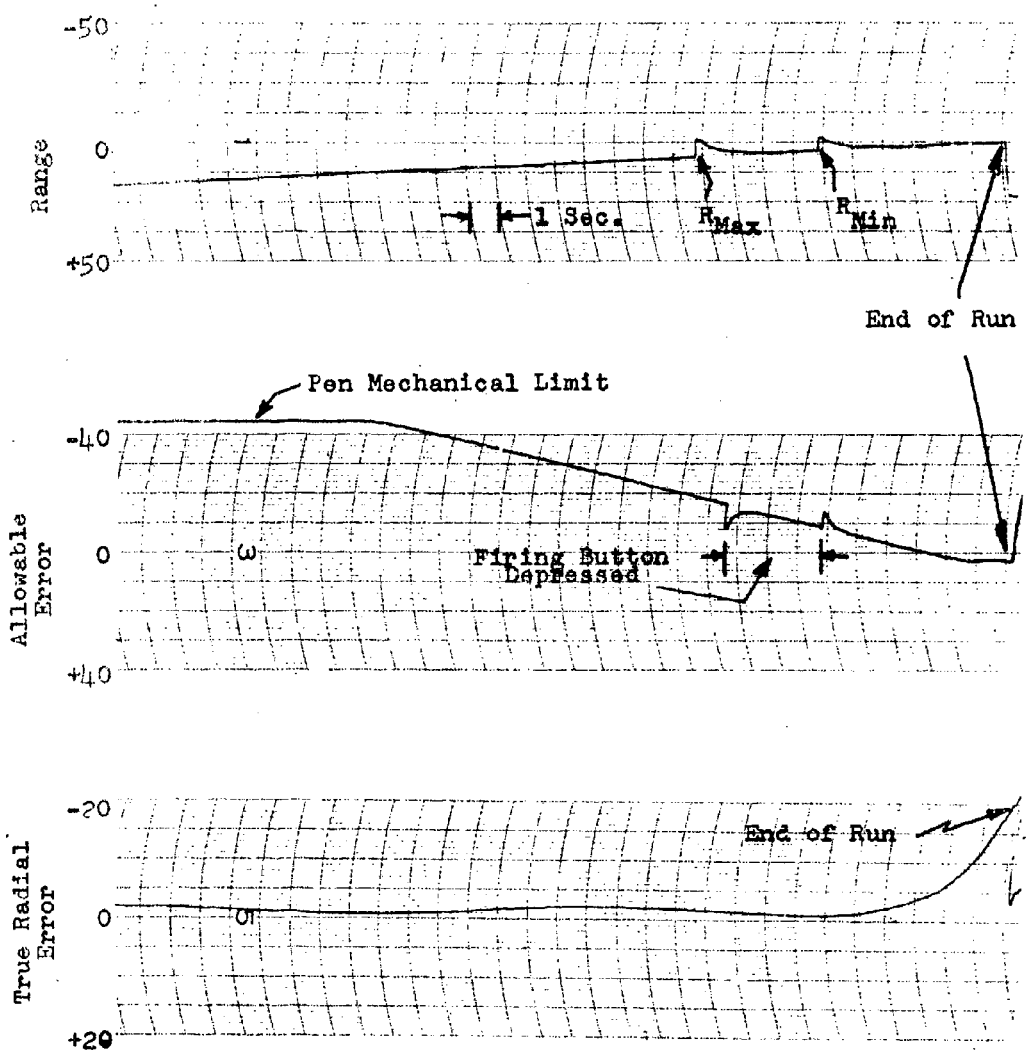


Fig. 7- Sample of Brush Recording Condition 3-151-03
(Run 137)

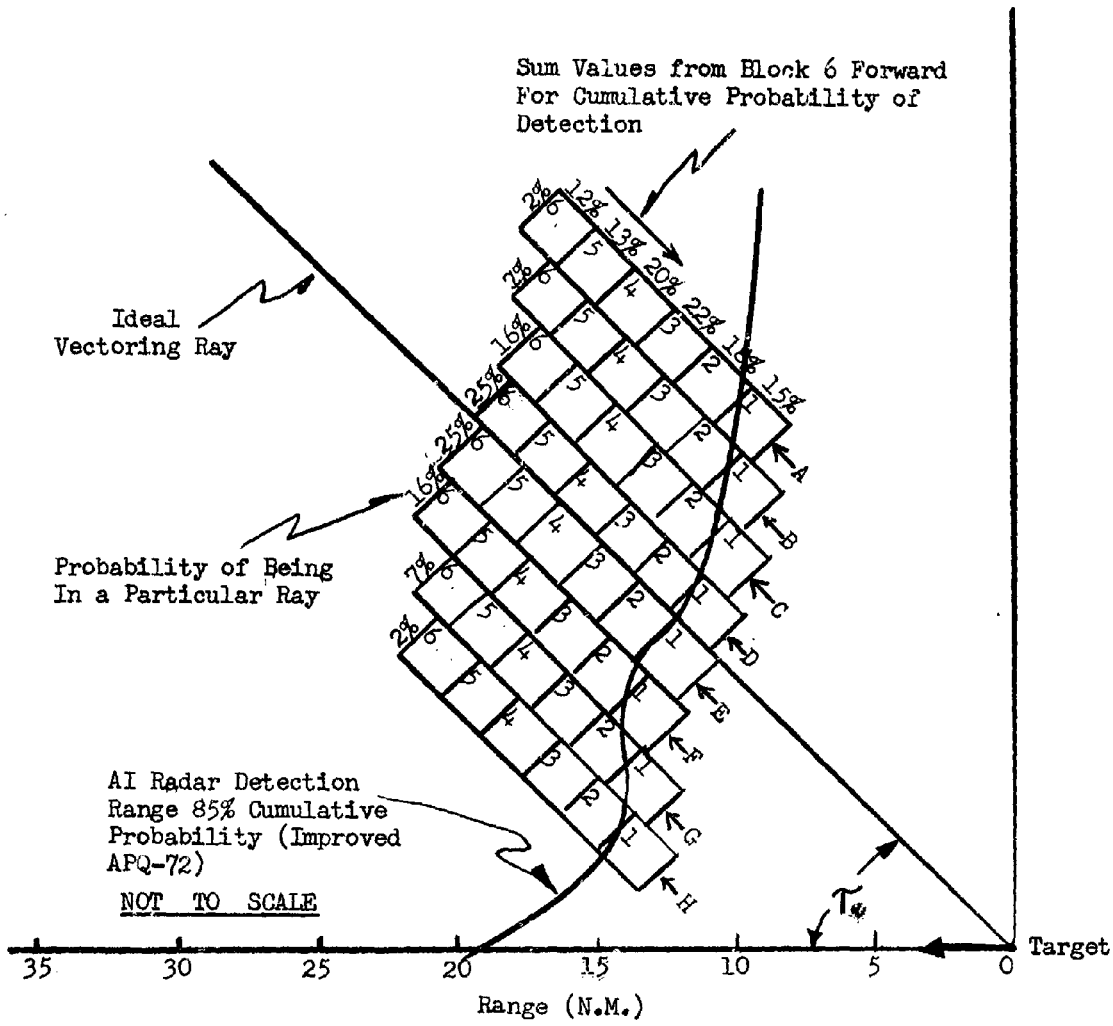


Figure 8 Weighting Factors Due to Vectoring Error and Detection Probability Distributions

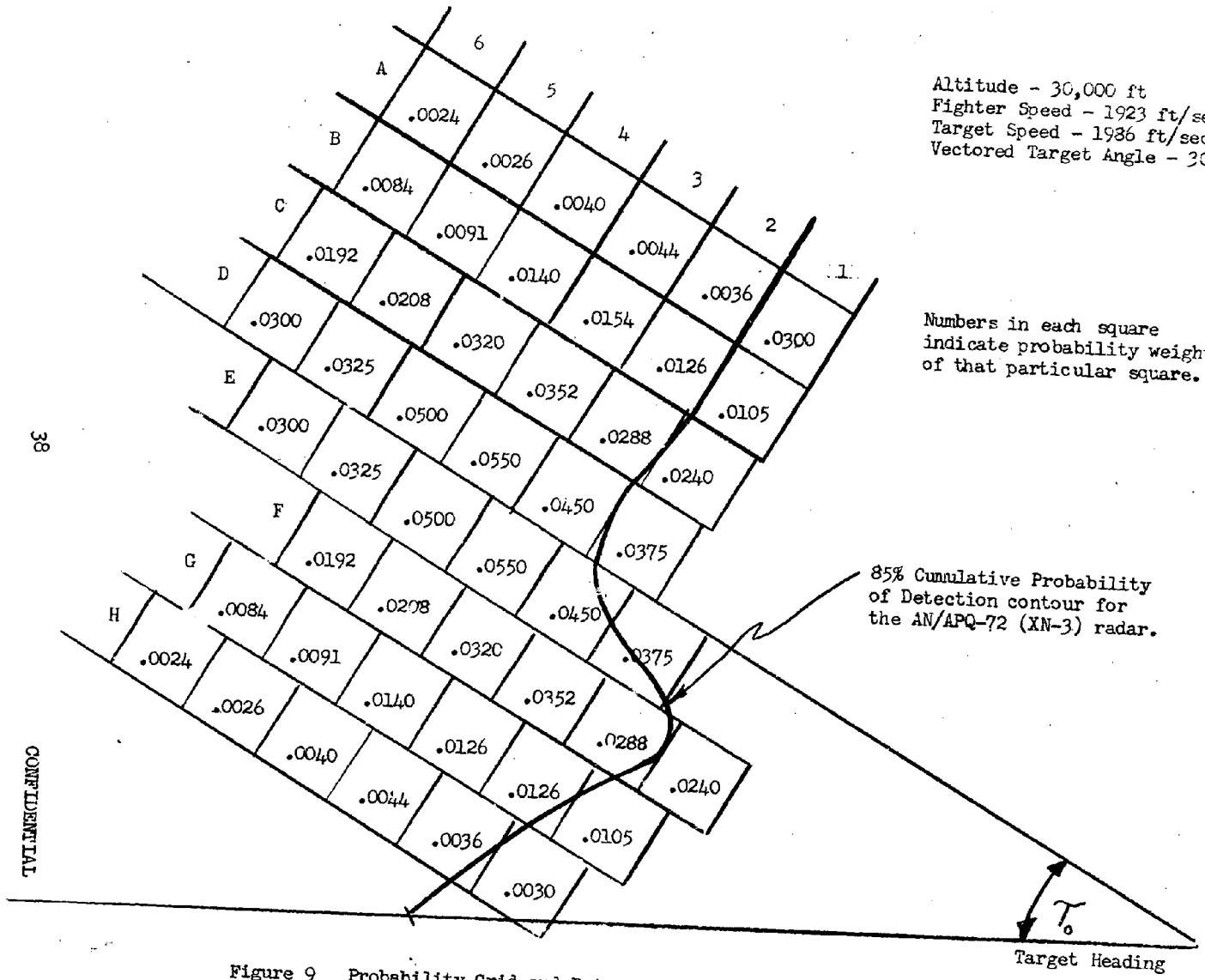
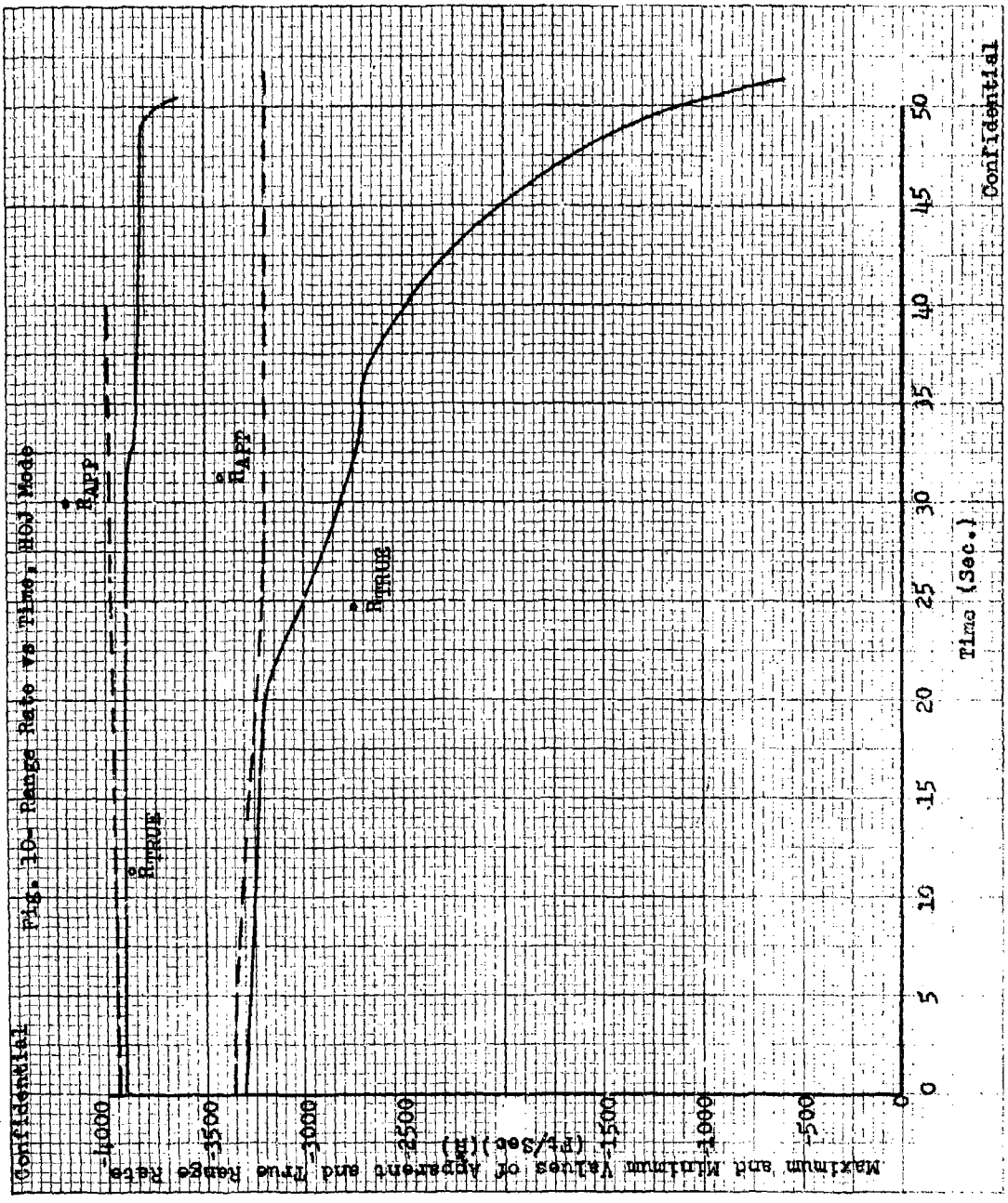


Figure 9 Probability Grid and Detection Probability Distributions



Code #	R_o Initial Range (n.m.)	ψ_o Initial Aircraft Heading (deg)	R_d Detection Range (n.m.)	λe_o Initial Elec. Gimbal Angle (deg)	λa_o Initial A_x Gimbal Angle (deg)
1-15R-A4	29.2	+30	22.4	-0.69	- 1.1
2-15L-C4	27.75	-30	20.72	-0.68	+ 8.8
3-15R-D3	24.5	+30	17.5	-0.675	-12.7
4-15L-E2	22.9	-30	15.85	-0.658	+17.5
5-15R-F5	30.45	+30	23.45	-0.646	-20.6
6-30L-B3	27.35	-60	20.5	-0.65	+19.5
7-30R-D4	29.65	+60	22.7	-0.608	-28
8-30L-E2	23.85	-60	16.85	-0.581	+32.3
9-30R-F5	28.4	+60	19.55	-0.558	-36
10-30L-G4	27.4	-60	20.35	-0.523	+40.5
10-30L-G5*	29.15	-60	22.25	-0.45	+39.7

TABLE 1

Initial Condition Set No. 1 Used for
Runs #1-100, 201-300, 401-500, 601-700, 801-9000, 1001-1100

*From Run #237, G5 is used rather than G4

Code #	R_o Initial Range (n.m.)	Ψ_o Initial Aircraft Heading (deg)	R_d Detection Range (n.m.)	λe_o Initial Elec. Gimbal Angle (deg)	λa_o Initial A_x Gimbal Angle (deg)
1-15L-A4	29.2	-30	22.4	-0.69	+ 1.1
2-15R-C4	27.75	+30	20.72	-0.68	- 8.8
3-15L-D3	24.5	-30	17.5	-0.675	+12.7
4-15R-E2	22.9	+30	15.85	-0.658	-17.5
5-15L-F5	30.45	-30	23.45	-0.646	+20.6
6-30L-B3	27.35	+60	20.5	-0.65	-19.5
7-30L-D4	29.65	-60	22.7	-0.608	+28
8-30R-E2	23.85	+60	16.85	-0.581	-32.3
9-30L-F5	28.4	-60	19.55	-0.558	+36
10-30R-G4	27.4	+60	20.35	-0.523	-40.5
10-30h-G5*	29.15	+60	22.25	-0.45	-39.7

TABLE 2

Initial Condition Set No. 2 Used for
Runs #101-200, 301-400, 501-600, 701-800, 901-100, 1101-1200

*From Run #237, G5 is used rather than G4

TABLE 5

Summary of Results, HCJ Mode, Set No. 1

Code	1-15R-A4		2-15L-C4		3-15R-D3		4-15L-E2		5-15R-F5		6-30L-B3		7-30R-D4		8-30L-E2		9-30R-F5		10-30L-G4/5		Totals	
Polarity of R Drift	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Successes			5	5	5	5	4	5	5	5	1	1	5	5	5	5	4	5	2	2	36	38
Failures Due To Steering Errors	2	3															1		3	3	6	6
Failures Due To Firing Before True R_{max}	3	2									4	4									7	6
Failure To Fire When Permissible							1														1	
Total Runs Made	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	50

Total No. Valid Runs = 100

Total No. Successes = 74

Percent Success = 74

TABLE 5.1

Results of Simulation

HOJ Mode, Evaluation Set. No. 1

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec. After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
201	8-30L-E2	-	yes	14	14	6	6.5	8	8.5	3	3		S
202	1-15R-A4	-	Fired 1.5 sec Before R_{max}	15	14	6	3	11	10	3.5	3		F
203	3-15R-D3	-	yes	16	14	2	1.5	11	11	1.5	1		S
204	2-15L-C4	-	yes	16	14	2	2	12	10	1.5	1		S
205	10-30L-G4	-	Not fired	16	14	>20	>20	11	12	>20	>20	*	F
206	7-30R-D4	-	yes	12	15	3	3	9	11	2	1		S
207	5-15R-F5	-	yes	13	12	3.5	3	8	8	2.5	2		S
208	4-15L-E2	-	yes	14	14	9	9	9	10	4	4		S
209	9-30R-F5	-	yes	13	14	5.5	6	8	10.5	3	3		S
210	6-30L-B3	-	yes	11	10	4	3.5	8	7	4	5.5		S
211	4-15L-E2	+	Not fired	16	16	12	12	10	11	8	9	Could have Fired*	F
212	3-15R-D3	+	yes	16	14	2	2	10	10	2	2		S
213	2-15L-C4	+	yes	16	14	0	0.5	11	9	1	1.5		S
214	8-30L-E2	+	yes	14	14.5	4	5	10	10	1	1		S
215	7-30R-D4	+	yes	13	15	5	5	9	11	4	4		S
216	1-15R-A4	+	Fired 2 sec. Before R_{max}	15	14	7	5	10	10	4	1		F
217	10-30L-G4	+	Not fired	17	15	20	>20	12	12	>20	>20	*	F
218	6-30L-B3	+	Fired 1 sec. Before R_{max}	13	12	1.5	0.5	10	9.5	2	0.5		F
219	9-30R-F5	+	yes	14	16	8	8.5	8	12	4	4		S
220	5-15R-F5	+	yes	13	13	2	2	8	9	1	1		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 5.2

Results of Simulation

HOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec. After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
221	9-30R-F5	-	yes	10.5	12	6.5	6	5	10	3	3		S
222	10-30L-G4	-	Not fired	17.5	16	>20	20	12.5	12.5	>20	>20	*	F
223	4-15L-E2	-	yes	15	14	7	>7	9	9.5	3	4		S
224	1-15R-A4	-	Fired 2 sec. Before R_{max}	16	15	3.5	1	12	10	2	5		F
225	2-15L-C4	-	yes	16	14	3	3	12	9.5	2	1.5		S
226	3-15R-D3	-	yes	16	14	1.5	1.5	11	9	1.5	1.5		S
227	7-30R-D4	-	yes	13	14	1.5	2	10	11	3	3		S
228	5-15R-F5	-	yes	14	12.5	3	3	8	8	2.5	3		S
229	6-30L-B3	-	Fired 1.5 sec Before R_{max}	14	13	2	1	11	10	3	8		F
230	8-30L-E2	-	yes	10	10	2	2.5	4	7	1.5	2		S
231	1-15R-A4	+	Fired 2 sec. Before R_{max}	15	14	6.5	4	12	9	3.5	2.5		F
232	2-15L-C4	+	yes	16	14	1.5	1	12	9.5	2	1.5		S
233	8-30L-E2	+	yes	16	14	7	7	10	11	4.5	5		S
234	6-30L-B3	+	Fired 1.5 sec Before R_{max}	14	12.5	4	4	11	10	4	6		F
235	5-15R-F5	+	yes	13	12	4	4.5	8	7.5	5	5		S
236	9-30R-F5	+	yes	14	16	6	6	10	12	3.5	3.5		S
237	3-15R-D3	+	yes	16	14	2	2	10	9.5	2	2		S
238	4-15L-E2	+	yes	14	12	8	8	8	7.5	4	4		S
239	10-30L-G5	+	Not fired	18.5	18.5	>20	>20	13.5	16	>20	>20	*	F
240	7-30R-D4	+	yes	14	16	1.5	2	10	12	1.5	2		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of R_{max} is 0 to 15 degrees.

TABLE 5.3

Results of Simulation

HOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
241	3-15R-D3	-	yes	14	14	3	2.5	9.5	8	3	2.5		S
242	9-30R-F5	-	yes	14	16	9.5	10	8	12	6.5	7		S
243	10-30L-G5	-	yes	12	16	7	7.5	8	12	4.5	5		S
244	1-15R-A4	-	Not fired	14	12	18	14.5	10	8	18	13	*	F
245	5-15R-F5	-	yes	15	14	2.5	2.5	10	9	2.5	2		S
246	8-30L-E2	-	yes	17	16	5.5	5.5	11.5	12	1	1		S
247	2-15L-C4	-	yes	17	15	1	1	12	10	1	1		S
248	7-30R-D4	-	yes	14	14	4	4	10	11.5	4	4		S
249	6-30L-B3	-	Fired 1 sec. Before R_{max}	14	14	5	4	10	10	2	1.5		F
250	4-15L-E2	-	yes	14	14	11	11	11.5	10	7.5	7.5		S
251	8-30L-E2	+	yes	16	16	6.5	6.5	11.5	12	2	2		S
252	10-30L-G5	+	Not fired	18	17	>20	>20	13	14	>20	>20	*	F
253	3-15R-D3	+	yes	15	14	2	2	10	9	2.5	2.5		S
254	4-15L-E2	+	yes	14.5	9	14.5	9	9	10	7	7		S
255	7-30R-D4	+	yes	14	16	3	2.5	11	12	1.5	1.5		S
256	5-15R-F5	+	yes	15	14	3	3	10	9.5	2	2		S
257	1-15R-A4	+	yes	16	13	16	12	12	11	13	10		F
258	9-30R-F5	+	yes	13	15	8	8	8	12	5	5		S
259	6-30L-B3	+	Fired 1 sec. Before R_{max}	14	14	2	2	11	10.5	3	3		F
260	2-15L-C4	+	yes	16.5	14	1	1	12	9.5	0	0		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 5.4

Results of Simulation

HOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
261	10-30L-G5	-	yes	10	14.5	9	10	5	11	7.5	8.5		F
262	4-15L-E2	-	yes	13.5	14	8	8.5	8	9.5	4.5	4.5		S
263	1-15R-A4	-	Not fired	14	13	15	12	10	8	14	10	*	F
264	2-15L-C4	-	yes	15	14.5	2	2	10	10	1	1		S
265	5-15R-F5	-	yes	12	13	2	2	7.5	8	1	1		S
266	8-30L-E2	-	yes	14	16	6.5	6.5	9	12	3	3		S
267	6-30L-B3	-	Fired 1 sec. Before R_{max}	12	14	4	3	9.5	10	3.5	2		F
268	3-15R-D3	-	yes	14	14	3	3	9	10	3	3		S
269	9-30R-F5	-	yes	14	16	8	8	9	13.5	4	4		S
270	7-30R-D4	-	yes	12	16	2	3	9	12	1	1.5		S
271	3-15R-D3	+	yes	13	14	2	2	10	10	2	2		S
272	9-30R-F5	+	Not fired	12	18	16	16	9.5	14	13	13	*	F
273	4-15L-E2	+	yes	13	12	7	7	9	9.5	3	3		S
274	2-15L-C4	+	yes	9	14	4	3	6	10	3	3		S
275	5-15R-F5	+	yes	14	14	2.5	2.5	11	9	1.5	1.5		S
276	8-30L-E2	+	yes	12.5	16	5	5	10	12	1.5	1.5		S
277	6-30L-B3	+	Fired 0.75 sec. Before R_{max}	13	14	3	2	9.5	11	3	2	Marginal Failure	F
278	10-30L-G5	+	yes	12	16	5	7.5	7	13	1.5	1.5		S
279	7-30R-D4	+	yes	12	16	3.5	4	8	12	4.5	5		S
280	1-15R-A4	+	Not fired	10	13	>20	18	6	8	>20	17	*	F

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - an attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 5.5

Results of Simulation

HOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
281	7-30R-D4	-	yes	12	16	3	3	9	12	1	1		S
282	10-30L-G5	-	yes	13	16	8	8.5	8	12	6	6.5		S
283	1-15R-A4	-	yes	16	16	15.	13	12.5	11	14	13.		F
284	9-30R-F5	-	yes	14	16	8	8	8	12	5	5		S
285	3-15R-D3	-	yes	15	15	2	2	9.5	9.5	2.5	2.5		S
286	2-15L-C4	-	yes	16	15	3	2	11	10	2	1.5		S
287	8-30L-E2	-	yes	16	16	5	4.5	11	12	2	2		S
288	5-15R-F5	-	yes	14	14	2	2	9.5	9.5	1	1		S
289	6-30L-B3	-	Fired 1 sec. Before True R_{max}	11	14	1.5	1	8	11	1.5	0.5		F
290	4-15L-E2	-	yes	14	14	10	10	9	9.5	6.5	6.5		S
291	2-15L-C4	+	yes	15	14	1.5	1	11	10	0.5	0.5		S
292	5-15R-F5	+	yes	13	13	3	3	8	8.5	1.5	1		S
293	7-30R-D4	+	yes	12	14	2	2	8	11.5	2	2		S
294	9-30R-F5	+	yes	13	15	7	7.5	8	11	3.5	4		S
295	4-15L-E2	+	yes	17	15	9	9	12	10	5.5	5		S
296	3-15R-D3	+	yes	18	14	2	2	12.5	9.5	2	2		S
297	10-30L-G5	+	yes	12	16	8.5	9	8	13	5.5	7		S
298	1-15R-A4	+	Fired 1.5 sec. Before True R_{max}	14	14	11	9	10	10	10	7		F
299	6-30L-B3	+	yes	9	13	3	1.5	6	9	3	1		S
300	8-30L-E2	+	yes	15	15	6.5	6.5	10	12	3	3		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 6

Summary of Results, HOJ Mode, Set No. 2

Code	1-15L-A4		2-15R-C4		3-15L-D3		4-15R-E2		5-15R-E2		6-30R-B3		7-30L-D4		8-30R-E2		9-30L-F5		10-30R-C5		Totals	
Polarity of R Drift	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
Successes			5	5	5	5	5	4	5	5	1	1	5	5	5	5	3	4	3	1	37	35
Failures Due To Steering Errors	5	5															1		1	3	7	8
Failures Due To Firing Before True R_{max}											4	4									4	4
Failure to Fire When Permissible								1									1	1	1	1	2	3
Total Runs Made	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	50	50

Total No. Valid Runs = 100

Total No. Successes = 72

Percent Success = 72

TABLE 6.1

Results of Simulation

HOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec. After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
301	8-30R-E2	-	yes	14	15	7	6.5	9	11	2.5	2		S
302	1-15L-A4	-	Not fired	12	11	13.5	10	8	6	13	8	*	F
303	3-15L-D3	-	yes	14	14	2	2	9	9.5	2	1.5		S
304	2-15R-C4	-	yes	15.5	15	2.5	2	10.5	10	2	2		S
305	10-30R-G5	-	Not fired	16	18	13.5	14	11	15.5	11	11.5	Could have Fired *	F
306	7-30L-D4	-	yes	12.5	14	1	1	9	10.5	1.5	1		S
307	5-15L-F5	-	yes	12	14	3	3	8	9.5	3	2.5		S
308	4-15R-E2	-	yes	14	14	9.5	9.5	8	9	5.5	5.5		S
309	9-30L-F5	-	yes	12	15	6	6	7	10	2	2.5		S
310	6-30R-B3	-	Fired 1.0 sec. Before R_{max}	13	13	4	3	9	10	4	2		F
311	4-15R-E2	+	yes	13	14	9	8.5	8	9.5	5	5		S
312	3-15L-D3	+	yes	14	15	2	2	10	10.5	2	2		S
313	2-15R-C4	+	yes	16	16	3.5	3	10	10.5	2	2		S
314	8-30R-E2	+	yes	11	16	7.5	7	9.5	13	3	3		S
315	7-30L-D4	+	yes	12	15	1	1.5	8	12	1	1		S
316	1-15L-A4	+	Not fired	12	13	17.5	14	8	9	17.5	13	*	F
317	10-30R-G5	+	yes	38	16	3	3	30	12	3.5	4		S
318	6-30R-B3	+	Fired 0.5 sec. Before R_{max}	13	14	2.5	1.5	8	10	3	2	Marginally Early Firing	S
319	9-30L-F5	+	Not fired	16	18	15.5	15.5	11	15	12	12	*	F
320	5-15L-F5	+	yes	14	15	1	1	8	10	0.5	0.5		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 6.2

Results of Simulation

HOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec. After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
321	C-30L-F5	-	yes	13	16	9	9	8	7.4	5	3		S
322	10-30R-G5	-	Not fired	15	19	15	15	11	16	12.5	13	*	F
323	4-15R-E2	-	yes	14	15	9	9	8	9.5	6	6		S
324	1-15L-A4	-	Not fired	12	12	15	11.5	8	7	14	9	*	F
325	2-15R-C4	-	yes	16	15	2	1.5	11	11	1	1		S
326	3-15L-D3	-	yes	13	13.5	1	1	8	8	1	1		S
327	7-30L-D4	-	yes	12	15	2	2	9	11.5	2	2		S
328	5-15L-F5	-	yes	13	14	1	1	8	10	0.5	0.5		S
329	6-30R-B3	-	Fired 1.0 sec. Before R_{max}	13	14	3	2	9	11	3.5	2.0		F
330	8-30R-E2	-	yes	14	16	4	4	8	12	2	2		S
331	1-15L-A4	+	Not fired	13	12	15	12	8	8	14	10	*	F
332	2-15R-C4	+	yes	15	14	3	3	10	10	2	2		S
333	8-30R-E2	+	yes	14	15.5	5.5	5.5	9	11.5	2	2		S
334	6-30R-B3	+	Fired .25 sec. Before R_{max}	11	13	2	1	8	9.5	5	3	Marginally Early Firing	F
335	5-15L-F5	+	yes	13	14	1.5	1.5	8	9	1	1		S
336	9-30L-F5	+	yes	12	16	8.5	8.5	7	11	4	4		S
337	3-15L-D3	+	yes	14	14	1	1	9.5	9	1	1		S
338	4-15R-E2	+	yes	10.5	11.5	9	9	6	7	6	6		S
339	10-30R-G5	+	yes	11	16	10	11	6	12	8	9.5		S
340	7-30L-D4	+	yes	11	14	2	2	8	10	2	2.0		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 6.3

Results of Simulation

HOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec. After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
341	3-15L-D3	-	yes	15	14	2	2	10	9.5	1.5	1		S
342	9-30L-F5	-	yes	12	15	6.5	6.5	8	10.5	3	3		S
343	10-30R-G5	-	Not fired	16	18	17	18	11	14.5	15.5	16	*	F
344	1-15L-A4	-	Not fired	12.5	12	15	11.5	8	7	14.5	10	*	F
345	5-15L-F5	-	yes	14.5	14	1	1	10	9.5	1	1		S
346	8-30R-E2	-	yes	16	16	4.5	4.5	11	12	2	2		S
347	2-15R-C4	-	yes	14	10	3.5	2.5	10	6	7	6		S
348	7-30L-D4	-	yes	14	15	1	1	10	11.5	1.5	2		S
349	6-30R-B3	-	Fired 1.0 sec. Before R_{max}	14	13.5	3	2	10	10	3	1		F
350	4-15R-E2	-	Not fired	17.5	17	13	13	12	11	9	9	Could have Fired *	F
351	8-30R-E2	+	yes	15.5	15.5	5.5	5.5	10	11.5	1.5	2		S
352	10-30R-G5	+	Not fired	17	18	14	15	12	15	12	13	Could have Fired *	F
353	3-15L-D3	+	yes	16	14	1	1	10.5	9.5	1	1		S
354	4-15R-E2	+	yes	14	13	10	10	9	8	6.5	6.5		S
355	7-30L-D4	+	yes	12	13	3	3.5	9	10	2	2		S
356	5-15L-F5	+	yes	15	14	0.5	1	10	10	1	1		S
357	1-15L-A4	+	Not fired	14	12	17	13.5	9	7	16	11.5	*	F
358	9-30L-F5	+	yes	13	14.5	3.5	3.5	8	11	1	1		S
359	6-30R-B3	+	Fired 0.25 sec. Before R_{max}	13	12	3.5	2.5	9.5	9	3	1	Marginally Early Firing	F
360	2-15R-C4	+	yes	12	10	1	1	8	5	2.5	2		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 6.4

Results of Simulation

HOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Polarity of Drift in $\hat{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec. After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
361	10-30R-G5	-	yes	11	14	8	8.5	6	10.5	5.5	6.5		S
362	4-15R-E2	-	yes	14	13	8	8	9	8	4	4		S
363	1-15L-A4	-	Not fired	13	11	>20	17	9	7	>20	15.5	*	F
364	2-15R-C4	-	yes	16	14	3	2.5	12	9	3	2		S
365	5-15L-F5	-	yes	14	13	1	1	9	8	2	2		S
366	8-30R-E2	-	yes	15	15	5.5	5.5	10	10.5	1	1		S
367	6-30R-B3	-	yes	12	11	3	2	8	8	4	3		S
368	3-15L-D3	-	yes	16	14	2	2	11	9.5	2	2		S
369	9-30L-F5	-	Not fired	18	18	15	15	13	14	13	13	*	F
370	7-30L-D4	-	yes	14	14	1	1	10	10	2	2		S
371	3-15L-D3	+	yes	16	14	1	0.5	10	9	1	1		S
372	9-30L-F5	+	yes	14	15	11	11.5	9	11	9.5	10		S
373	4-15R-E2	+	yes	15	14	9.5	9.5	10	9	6	6		S
374	2-15R-C4	+	yes	16	14	1	1	11	9.5	1	0.5		S
375	5-15L-F5	+	yes	12	12	1	1	7	7	1.5	1.5		S
376	8-30R-E2	+	yes	12	12	3	3	6	8	1.5	2		S
377	6-30R-B3	+	yes	11	11	3	2	8	8.5	3	2.5		S
378	10-30R-G5	+	Not fired	17.5	17.5	19	19.5	13	15	17.5	18	*	F
379	7-30L-D4	+	yes	13	14	2	2	9	11	2	2		S
380	1-15L-A4	+	Not fired	14	13	20	18	9.5	9	>20	17	*	F

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 6.5

Results of Simulation

HOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Polarity of Drift in $\dot{R}$	Fired Between True R_{max} & R_{min}	Data at Firing Point				Data 2 Sec. After Firing				Remarks	Evaluation[2]
				E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)	E_{max}[3] True (Deg.)	E_{max} HOJ (Deg.)	E_R True (Deg.)	E_R HOJ (Deg.)		
381	7-30L-D4	-	yes	13	14	1	0.5	9	10	2.5	2		S
382	10-30R-G5	-	Not fired	17	18	17.5	18	12	14	15	16	*	F
383	1-15L-A4	-	Not fired	12	10	16	17	8	6	15	9.5	*	F
384	9-30L-F5	-	yes	13.5	15.5	4.5	5	8	11	2	2		S
385	3-15L-D3	-	yes	16	14	4.5	4	10.5	10	3.5	3		S
386	2-15R-C4	-	yes	17	15	2	1.5	12	10	2	2		S
387	8-30R-E2	-	yes	15	15.5	4.5	4.5	10.5	12	1	1		S
388	5-15L-F5	-	yes	14	13	1	1	9	8	2	2		S
389	6-30R-B3	-	Fired 1.0 sec Before R_{max}	14	13	2	1	10	10	3	2		F
390	4-15R-E2	-	yes	14	14	10	10	9	9	7	7		S
391	2-15R-C4	+	yes	16	14	1	1	11.5	10	2	2		S
392	5-15L-F5	+	yes	14	14	0.5	0.5	9	10	0.5	0.5		S
393	7-30L-D4	+	yes	12	13.5	1	1	9	10	3	3		S
394	9-30L-F5	+	Not fired	17.5	17.5	14	14	12	15	11.5	12	Could have Fired *	F
395	4-15R-E2	+	yes	12	11.5	9	9	7	6	5.5	5.5		S
396	3-15L-D3	+	yes	15	13	2	2	9.5	9	2	2		S
397	10-30R-G5	+	yes	10	14	1.5	2	5.5	11	3	3.5		S
398	1-15L-A4	+	Not fired	13	12	17	13.5	9	7	16.5	11.5	*	F
399	6-30R-B3	+	Fired .25 sec Before R_{max}	12	12.5	3	2	9.5	9	3.5	2	Marginally Early Firing	F
400	8-30R-E2	+	yes	15.5	15.5	4	3.5	10	11	1	1		S

Notes: * For data at firing point, values given for true R_{max}.
For data 2 sec. after firing, values given 2 sec. after true R_{max}.

1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 7

Summary of Results

AOJ Mode, Set No. 1

Code	1-15R-A4	2-15L-C4	3-15R-D3	4-15L-E2	5-15R-F5	6-30L-B3	7-30R-D4	8-30L-E2	9-30R-F5	10-30L-G5	Totals
Successes	1	4	7	2	3		2	8	4	5	36
Failures Due to Steering Errors	3	2	1			4	4	1	3	3	21
No. of Firings Before True R_{max}	6	4			1	6	4		1		22
No. of Firings After True R_{min}			2	4	6				2	2	16
Failure to Fire During Run				4				1			5
Total Runs Made	10	10	10	10	10	10	10	10	10	10	100
Successful Second Missile Firings					0	0	0				0
Failure of Second Missile Due to Steering Errors						8	2				10
Second Missile Failures Due to Late Firing and Steering Errors					1						1

R Total Number Valid Runs = 100
Total Number Successes = 36
Percent Success = 36

TABLE 7.1

Results of Simulation

AOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True (Deg.)	E_R True (Deg.)	R_{min} (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(1)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(2)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	
401	8-30L-E2	yes	19	7.5	3.8	7.0	10.5	5.5	13.5	10.0				S
402	1-15R-A4	Fired 10.0 sec. Before R_{max}	16	14.5	2.7	6.0	>20.0	12.0	32.0	16.0				F
403	3-15R-D3	yes	19	12.0	3.9	8.0	9.5	6.5	19.0	12.0				S
404	2-15L-C4	yes	18	12.2	3.5	6.0	11.0	6.5	18.0	12.2				S
405	10-30L-G5	yes	18	10.0	3.8	6.0	9.0	5.5	12.0	10.0				S
406	7-30R-D4	Fired 6.5 sec. Before R_{max}	16	14.5	3.0	4.0	18.0	10.0	29.0	17.0				F
407a	5-15R-F5	Fired 5.0 sec. Before R_{max}	17	4.5	4.0	7.5	4.0	10.0	31.0	6.0				F
407b	5-15R-F5	Fired 2.0 sec. After R_{min}									2.5	2.0	3.5	F
408	4-15L-E2	Fired 0.5 sec. After R_{min}	17	1.0	4.1	8.0	6.0	3.6	6.0	6.5				F
409	9-30R-F5	yes	18	9.0	3.8	6.0	10.0	4.5	10.0	10.0				S
410a	6-30L-B3	Fired 9.0 sec. Before R_{max}	11	15.5	None	-	-	11.0	27.5	19.0				F
410b	6-30L-B3	yes									5.0	9.5	14.0	F
411	4-15L-E2	Fired 2.5 sec. After R_{min}	17	2.0	4.0	6.0	3.5	2.5	0.0	4.0				F
412	3-15R-D3	yes	18	11.0	3.8	8.0	8.5	5.8	16.0	11.0				S
413	2-15L-C4	yes	17	12.0	3.7	6.0	11.0	5.3	10.5	11.0				F
414	8-30L-E2	yes	19	10.0	3.8	7.0	10.0	4.6	10.0	10.0				S
415	7-30R-D4	Fired 5.0 sec. Before R_{max}	15	14.5	3.0	4.0	14.5	10.0	16.0	18.0				F

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 7.2

Results of Simulation

AOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True (Deg.)	E_R True (Deg.)	R_{min} (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	R(1)F (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	R(2)F (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	
416	1-15R-A4	yes	16.0	15.0	2.6	5.0	19.0	6.2	14.5	15.0				F
417	10-30L-G5	yes	17.0	10.5	3.8	7.0	8.0	6.0	15.0	10.0				S
418a	6-30L-B3	Fired 9.5 sec. Before R_{max}	10.5	15.5	None	-	-	12.0	28.0	19.5				F
418b	6-30L-B3	yes									5.5	9.5	15.0	F
419	9-30R-F5	Fired 0.5 sec. After R_{min}	18.0	9.0	3.8	7.0	8.0	3.5	6.0	7.5				F
420	5-15R-F5	yes	16.5	6.5	4.0	6.0	6.0	5.0	10.0	6.5				S
421	9-30R-F5	yes	18.0	8.5	3.8	6.0	10.5	4.2	9.0	10.2				F
422	10-30L-G5	yes	18.0	10.0	3.8	6.0	8.0	4.2	8.0	9.0				F
423	4-15L-E2	Not fired	17.0	3.0	4.1	7.0	7.0	-	-	-				F
424	1-15R-A4	Fired 1.0 sec. Before R_{max}	15.0	14.0	2.6	4.0	19.0	7.2	17.0	14.5				F
425	2-15L-C4	Fired 3.5 sec. Before R_{max}	17.0	10.5	3.7	5.0	10.0	10.0	27.0	12.0				F
426	3-15R-D3	yes	18.0	9.0	3.9	7.5	6.0	6.1	16.0	8.0				S
427	7-30R-D4	yes	14.5	12.0	3.0	4.0	12.0	5.5	11.5	11.0				S
428	5-15R-F5	Fired 2.0 sec. After R_{min}	16.5	5.0	4.0	7.0	3.0	2.8	2.0	2.0				F
429	6-30L-B3	Fired 2.5 sec. Before R_{max}	11.0	15.0	None	-	-	8.0	16.0	15.0				F
430	8-30L-E2	yes	19.0	8.0	3.8	7.0	11.5	4.8	12.0	11.0				S

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 7.3

Results of Simulation

AOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True (Deg.)	E_R True (Deg.)	R_{min} (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(1)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(2)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	
431	1-15R-A4	Fired 0.75 sec. Before R_{max}	15.5	14.0	2.6	4.0	>20.0	7.0	17.0	14.0				F
432	2-15L-C4	yes	18.0	10.0	3.7	6.0	8.5	5.5	12.0	9.5				S
433	8-30L-E2	yes	18.5	9.0	3.8	6.0	11.0	4.2	8.0	10.5				F
434a	6-30L-B3	Fired 6.5 sec. Before R_{max}	10.5	15.5	None	-	-	10.0	24.0	19.0				F
434b	6-30L-B3	yes									5.0	10.0	14.0	F
435	5-15R-F5	yes	16.5	6.0	4.0	6.0	4.0	4.1	7.0	4.0				S
436	9-30R-F5	yes	17.0	8.0	3.8	6.0	10.0	4.7	10.0	9.5				S
437	3-15R-D3	Fired 1.5 sec. After R_{min}	18.0	9.5	3.9	7.0	8.0	3.0	4.5	8.0				F
438	4-15L-E2	Not fired	17.0	4.5	4.1	6.0	1.0	-	-	-				F
439	10-30L-G5	yes	17.0	7.0	3.8	6.0	5.0	5.3	13.5	7.0				S
440	7-30R-D4	Fired 1.75 sec. Before R_{max}	14.0	14.0	3.0	4.0	14.5	7.6	18.0	14.5				F
441	3-15R-D3	yes	18.0	9.0	3.9	7.5	8.5	4.8	12.0	9.0				S
442	9-30R-F5	yes	18.0	9.0	3.8	6.0	9.5	4.1	9.0	10.0				F
443	10-30L-G5	Fired 2.0 sec. After R_{min}	17.0	5.0	3.8	6.0	4.0	2.6	2.0	4.0				F
444	1-15R-A4	Fired 1.25 sec. Before R_{max}	15.0	15.0	None	-	-	7.2	17.0	15.0				F
445	5-15R-F5	Fired 3.5 sec. After R_{min}	16.0	5.0	4.0	7.0	4.0	1.8	2.0	4.0				F

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5. n.m.

TABLE 7.4

Results of Simulation

AOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for Second Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True (Deg.)	E_R True (Deg.)	R_{min} (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	R(1)F (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	R(2)F (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	
446	8-30L-E2	Not fired	18.0	10.0	3.75	7.0	16.0	-	-	-				F
447	2-15L-C4	Fired 1.5 sec. Before R_{max}	17.0	10.5	3.7	6.0	9.0	7.3	21.0	12.0				F
448	7-30R-D4	Fired 5.5 sec. Before R_{max}	15.0	17.0	3.0	4.0	>20.0	8.7	26.0	17.0				F
449a	6-30L-B3	yes	10.0	14.0	None	-	-	6.3	10.0	14.0				F
449b	6-30L-B3	yes									2.5	4.0	11.0	F
450	4-15L-E2	Not fired	16.5	3.0	4.1	7.0	5.0	-	-	-				F
451	8-30L-E2	yes	18.0	10.0	3.8	6.0	14.5	6.5	18.0	10.0				S
452	10-30L-G5	yes	16.0	8.5	3.8	6.0	7.0	3.8	6.0	7.0				F
453	3-15R-D3	yes	17.0	11.5	3.3	6.0	10.0	5.9	15.0	11.0				S
454	4-15L-E2	Fired 2.25 sec. After R_{min}	16.0	2.0	4.1	6.0	5.0	2.7	0.0	7.5				F
455	7-30R-D4	yes	14.0	11.5	3.0	2.0	10.0	6.0	12.0	11.0				S
456	5-15R-F5	Fired 3.5 sec. After R_{min}	16.0	2.5	4.0	6.0	2.5	1.7	0.0	2.0				F
457	1-15R-A4	yes	15.0	13.0	2.6	5.0	15.0	6.0	12.0	12.0				S
458	9-30R-F5	Fired 0.25 sec. After R_{min}	17.0	8.0	3. .	6.0	10.0	3.6	6.0	10.0				F
459a	6-30L-B3	Fired 1.0 sec. Before R_{max}	10.0	14.0	None	-	-	6.7	12.0	14.5				F
459b	6-30L-B3	yes									2.5	4.0	12.5	F
460	2-15L-C4	yes	16.5	11.0	3.7	5.0	9.0	4.5	7.0	9.5				F

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 7.5

Results of Simulation

AOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True (Deg.)	E_R True (Deg.)	R_{min} (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(1)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(2)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	
461	10-30L-C5	yes	16.0	4.5	3.8	6.0	7.0	3.8	6.0	7.0				F
462	4-15L-E2	yes	16.0	6.0	4.1	4.0	6.0	4.5	7.5	5.0				S
463	1-15R-A4	yes	14.5	13.0	2.6	4.5	>20.0	6.1	12.5	13.0				F
464	2-15L-C4	yes	17.0	10.0	3.7	5.5	8.0	4.9	9.0	9.0				S
465	5-15R-F5	Fired 4.0 sec. After R_{min}	16.0	3.0	4.0	6.0	2.0	1.2	0.0	1.0				F
466	8-30L-E2	yes	18.0	10.5	3.8	8.0	17.0	6.2	16.5	11.0				S
467	6-30L-B3	yes	10.0	14.5	None	-	-	5.8	9.0	13.5				F
468	3-15R-D3	yes	17.0	11.5	3.9	6.0	12.0	4.5	10.0	12.0				F
469	9-30R-F5	yes	17.0	9.0	3.8	6.0	8.0	4.8	12.0	9.0				S
470	7-30R-D4	yes	14.0	12.5	3.0	3.0	16.0	5.6	10.0	11.5				F
471	3-15R-D3	Fired 0.75 sec. After R_{min}	17.0	10.0	3.9	6.5	7.0	3.5	5.5	6.5				F
472	9-30R-F5	yes	17.0	7.0	3.8	6.0	9.0	4.3	8.5	9.0				F
473	4-15L-E2	Not fired	16.0	4.0	4.1	6.0	3.0	-	-	-				F
474	2-15L-C4	yes	17.0	10.0	3.7	6.0	9.0	6.1	15.0	9.5				S
475	5-15R-F5	Fired 2.5 sec. After R_{min}	16.0	4.0	4.0	6.5	4.0	2.4	0.0	3.5				F

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 7.6

Results of Simulation

AOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True (Deg.)	E_R True (Deg.)	R_{min} (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(1)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	$R_{(2)F}$ (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	
476	8-30L-E2	yes	18.0	5.5	3.8	7.0	13.0	5.5	14.0	8.0				S
477a	6-30L-B3	Fired 3.5 sec. Before R_{max}	11.0	16.5	None	-	-	7.2	18.0	17.0				F
477b	6-30L-B3	yes									4.5	8.0	16.0	F
478	10-30L-G5	Fired 1.25 sec. After R_{min}	16.0	5.0	3.8	6.0	7.5	3.0	3.0	8.0				F
479a	7-30R-D4	Fired 4.0 sec. Before R_{max}	14.0	12.5	3.0	4.0	12.0	8.4	24.0	15.0				F
479b	7-30R-D4	yes									4.0	6.5	11.0	F
480	1-15R-A4	Fired 4.0 sec. Before R_{max}	15.0	17.0	None	-	-	8.5	20.0	18.0				F
481	7-30R-D4	Fired 3.0 sec. Before R_{max}	14.0	15.0	3.0	4.0	18.5	8.0	21.0	16.0				F
482	10-30L-G5	yes	16.0	5.0	3.8	6.0	9.5	5.9	14.0	6.0				S
483	1-15R-A4	Fired 1.0 sec. Before R_{max}	14.0	14.0	2.6	4.0	>20.0	6.1	16.0	14.0				F
484	9-30R-F5	Fired 0.5 sec. Before R_{max}	16.0	10.5	3.8	6.0	14.0	6.2	18.0	10.0				F
485	3-15R-D3	yes	17.0	12.0	3.9	7.0	10.0	5.5	13.0	11.0				S
486	2-15L-C4	Fired 0.5 sec. Before R_{max}	15.5	11.0	3.7	5.0	9.5	6.8	18.0	11.5				F
487	8-30L-E2	yes	18.0	9.0	3.8	6.0	17.5	6.2	16.5	10.0				S

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 7.7

Results of Simulation

AOJ Mode, Evaluation Set No. 1

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True (Deg.)	E_R True (Deg.)	R_{min} (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	R(1)F (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	R(2)F (n.m.)	E_{max} True (Deg.)	E_R True (Deg.)	
488	5-15R-F5	Fired 3.25 sec. After R_{min}	16.0	4.0	4.0	7.0	3.5	1.8	0.0	3.0				F
489a	6-30L-B3	Fired 9.25 sec. Before R_{max}	10.0	15.0	None	-	-	9.6	28.0	20.0				F
489b	6-30L-B3	yes									5.3	10.0	13.0	F
490	4-15L-E2	yes	16.0	2.5	4.1	6.0	7.5	5.2	11.0	5.0				S
491	2-15L-C4	Fired 2.8 sec. Before R_{max}	17.0	13.0	3.7	5.0	12.0	9.0	24.0	13.5				F
492	5-15R-F5	yes	16.0	6.5	4.0	6.0	5.0	5.2	10.5	5.5				S
493a	7-30R-D4	Fired 5.0 sec. Before R_{max}	15.0	13.5	3.0	3.0	13.0	8.6	24.0	16.5				F
493b	7-30R-D4	yes									3.9	6.0	12.0	F
494	9-30R-F5	yes	18.0	10.5	3.8	6.0	10.5	5.9	16.0	10.5				S
495	4-15L-E2	Fired 1.0 sec. After R_{min}	16.0	3.0	4.1	6.5	5.0	3.5	4.0	6.0				F
496	3-15R-D3	yes	18.0	10.0	3.9	6.0	7.5	4.4	9.0	8.0				S
497	10-30L-G5	yes	16.0	6.0	3.8	5.5	4.5	4.4	8.0	5.0				S
498	1-15R-A4	yes	14.5	14.5	2.6	4.0	>20.0	5.6	12.0	14.5				F
499a	6-30L-B3	Fired 4.5 sec. Before R_{min}	10.5	15.5	None	-	-	8.0	20.0	17.5				F
499b	6-30L-B3	yes									4.4	8.0	13.5	F
500	8-30L-E2	yes	18.0	6.5	3.8	7.0	13.5	5.5	14.0	8.0				S

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 8

Summary of Results

AOJ Mode, Set No. 2

Code	1-15L-A4	2-15R-C4	3-15L-D3	4-15R-E2	5-15L-F5	6-30R-B3	7-30L-D4	8-30R-E2	9-30L-F5	10-30R-G5	Totals
Successes	2	6	8	1			1	9	7	3	37
Failures Due to Large Steering Errors	1	1				5	4	1	2		14
No. of Firings Before True R_{max}	7	3				5	5			1	21
No. of Firings After True R_{min}			2	9	10				1	6	28
Failure to Fire During Run											
Total Runs Made	10	10	10	10	10	10	10	10	10	10	100
Successful Second Missile Firings	0	0				0	0			0	
Failure of Second Missile Due to Steering Errors	3	1				4	5				13
Second Missile Failures Due to Late Firing and Steering Errors										1	1

Total Number Valid Runs = 100
Total Number Successes = 37
Normalized Percent Success = 37

TABLE 8.1

Results of Simulation

AOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True	E_R True	R_{min} (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(1)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(2)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	
501	8-30R-E2	yes	18.0	10.5	3.6	6.0	11.0	5.1	12.0	11.5				S
502	1-15L-A4	yes	15.0	15.0	None	-	-	6.5	14.5	14.5				S
503	3-15L-D3	yes	18.0	11.5	4.0	7.0	10.5	6.1	16.0	11.0				S
504a	2-15R-C4	Fired 6.0 sec. Before R_{max}	17.5	9.0	3.5	5.0	8.0	9.9	32.0	12.0				F
504b	2-15R-C4	yes									3.5	5.0	8.9	F
505	10-30R-G5	yes	16.0	5.5	4.0	6.0	5.5	4.0	6.0	5.5				S
506a	7-30L-D4	Fired 9.25 sec. Before R_{max}	14.5	14.0	3.0	4.0	12.5	9.7	33.0	19.0				F
506b	7-30L-D4	yes									4.9	9.0	11.0	F
507	5-15L-F5	Fired 2.75 sec. After R_{min}	16.0	7.0	3.8	7.0	4.5	2.0	0.0	3.0				F
508	4-15R-E2	Fired 0.75 sec. After R_{min}	16.5	4.5	3.8	7.0	7.0	3.3	5.0	6.5				F
509	9-30L-F5	yes	18.0	8.0	4.0	6.0	9.0	4.8	10.5	9.0				S
510a	6-30R-B3	Fired 4.0 sec. Before R_{max}	10.5	14.0	None	-	-	7.9	19.0	15.5				F
510b	6-30R-B3	yes									4.9	9.0	13.0	F
511	4-15R-E2	Fired 1.2 sec. After R_{min}	16.0	1.2	4.1	6.5	4.7	3.3	3.5	6.0				F
512	3-15L-D3	yes	18.5	9.5	4.1	6.5	8.2	4.9	10.0	9.0				S
513	2-15R-C4	Fired 0.3 sec. Before R_{max}	17.0	10.2	3.3	5.0	9.0	6.7	18.0	10.5				F
514	8-30R-E2	yes	18.0	8.0	3.6	6.5	11.6	4.2	10.0	11.5				F
515	7-30L-D4	yes	14.5	12.5	3.4	3.0	14.2	6.5	14.5	12.5				S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 8.2

Results of Simulation

AOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True	E_R True	R_{min} (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(1)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(2)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	
516	1-15L-A4	Fired 2.8 sec. Before R_{max}	15.0	14.3	3.1	4.0	>20.0	7.4	19.0	14.0				F
517	10-30R-G5	Fired 2.1 sec. After R_{min}	16.5	5.4	3.8	6.0	4.8	2.5	1.0	3.8				F
518	6-30R-B3	yes	10.0	14.0	None	-	-	4.1	8.5	12.8				F
519	9-30L-F5	yes	13.5	6.7	4.0	6.5	9.6	4.4	8.0	9.4				F
520	5-15L-F5	Fired 4.4 sec. After R_{min}	16.0	4.0	4.1	6.0	2.1	1.5	4.0	1.2				F
521	9-30L-F5	Fired 0.6 sec. After R_{min}	17.0	4.0	3.9	6.5	5.0	3.5	5.0	5.3				F
522	10-30R-G5	Fired 1.6 sec. After R_{min}	16.5	5.0	4.0	6.0	4.0	3.1	2.0	3.7				F
523	4-15R-B2	Fired 1.7 sec. After R_{min}	16.5	4.0	3.8	6.0	5.0	2.6	2.0	4.3				F
524	1-15L-A4	Fired 4.1 sec. Before R_{max}	15.0	15.7	None	-	-	7.4	20.5	16.0				F
525	2-15R-C4	Fired 0.5 sec. Before R_{max}	17.5	11.0	3.5	5.0	9.0	6.8	18.5	11.3				F
526	3-15L-D3	yes	17.0	9.0	4.0	7.0	7.5	4.5	8.5	8.0				S
527a	7-30L-D4	Fired 4.0 sec. Before R_{max}	14.5	12.0	3.35	3.0	10.3	9.0	22.0	14.0				F
527b	7-30L-D4	yes									4.0	6.5	9.5	F
528	5-15L-F5	Fired 2.0 sec. After R_{min}	16.0	4.0	4.1	6.5	4.0	2.8	1.0	4.2				F

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 8.3

Results of Simulation

AOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True	E_R True	R_{min} (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(1)F}$ True (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(2)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	
529a	6-30R-B3	Fired 3.8 sec. Before R_{max}	10.5	14.0	None	-	-	7.3	19.0	15.5				F
529b	6-30R-B3	yes									5.23	8.0	12.0	F
530	8-30R-E2	yes	18.0	9.0	3.62	6.5	11.0	5.6	15.0	9.5				S
531a	1-15L-A4	Fired 3.5 sec. Before R_{max}	15.5	13.3	2.9	5.5	13.3	7.7	20.5	14.0				F
531b	1-15L-A4	yes									4.2	5.5	12.0	F
532	2-15R-C4	yes	18.0	9.0	3.6	6.0	8.0	6.4	17.0	8.0				S
533	8-30R-E2	yes	18.5	9.6	3.75	8.0	11.2	5.1	12.5	11.0				S
534a	6-30R-B3	Fired 6.8 sec. Before R_{max}	11.0	13.2	None	-	-	9.6	24.5	18.0				F
534b	6-30R-B3	yes									4.6	9.0	11.6	F
535	5-15L-F5	Fired 3.2 sec. After R_{min}	16.5	4.0	4.1	7.5	3.5	2.0	2.0	1.6				F
536	9-30L-F5	yes	18.0	6.5	3.9	6.5	9.2	4.4	9.0	9.0				S
537	3-15L-D3	yes	18.0	9.4	4.0	7.5	7.0	5.3	13.5	8.3				S
538	4-15R-E2	Fired 3.1 sec. After R_{min}	17.0	2.2	3.8	7.0	4.4	1.5	1.5	4.0				F
539	10-30R-G5	Fired 2.6 sec. After R_{min}	17.5	2.7	4.1	6.5	2.3	2.5	0.0	2.0				F
540a	7-30L-D4	Fired 7.1 sec. Before R_{max}	16.5	13.0	3.25	4.0	13.8	10.7	29.5	16.6				F
540b	7-30L-D4	yes									3.9	9.5	12.0	F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 8.4

Results of Simulation

AOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max} True[3]	E_R True	R_{min} (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(1)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(2)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	
541	3-15L-D3	yes	17.5	8.0	3.75	7.0	5.0	6.1	16.0	7.7				S
542	9-30L-F5	yes	18.0	9.0	3.9	6.5	9.0	5.4	13.0	9.0				S
543	10-30R-G5	Fired 2.4 sec. After R_{min}	17.0	5.4	4.1	6.0	3.3	2.8	0.5	2.0				F
544a	1-15L-A4	Fired 7.9 sec. Before R_{max}	15.5	13.2	2.6	4.0	19.0	10.2	24.0	14.3				F
544b	1-15L-A4	yes									5.2	9.5	13.4	F
545	5-15L-F5	Fired 2.9 sec. After R_{min}	16.5	6.5	4.0	7.0	4.5	2.1	1.0	3.0				F
546	8-30R-E2	yes	18.5	7.6	3.9	7.5	13.6	5.2	13.5	11.0				S
547	2-15R-C4	yes	17.5	11.0	3.6	7.0	9.0	3.7	7.0	9.0				F
548a	7-30L-D4	Fired 4.7 sec. Before R_{max}	14.5	13.5	3.1	3.5	11.5	10.0	25.0	16.3				F
548b	7-30L-D4	yes									4.1	7.5	11.8	F
549	6-30R-B3	yes	10.5	14.5	None	-	-	5.8	9.5	14.0				F
550	4-15R-E2	Fired 1.0 sec. After R_{min}	16.0	2.5	3.9	6.5	5.0	3.2	3.0	5.0				F
551	8-30R-E2	yes	18.0	9.0	3.8	7.0	13.3	5.5	14.0	10.6				S
552	10-30R-G5	Fired 2.4 sec. After R_{min}	16.5	6.3	4.2	6.0	5.0	3.0	0.0	4.0				F
553	3-15L-D3	Fired 0.6 sec. After R_{min}	17.5	5.4	4.0	7.5	9.0	3.6	5.5	9.2				F
554	4-15R-E2	Fired 2.1 sec. After R_{min}	16.5	2.2	3.8	7.5	3.0	2.2	1.0	4.2				F
555a	7-30L-D4	Fired 4.5 sec. Before R_{max}	14.5	13.5	3.3	3.0	13.4	8.7	24.0	15.0				F
555b	7-30L-D4	yes									4.1	6.5	12.2	F

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 8.5

Results of Simulation

AOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max} True	E_R True	R_{min} (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(1)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	$R_{(2)F}$ (n.m.)	E_{max} True (deg)	E_R True (deg)	
556	5-15L-F5	Fired 3.0 sec. After R_{min}	16.0	3.7	4.1	6.5	2.3	2.1	2.0	2.0				F
557	1-15L-A4	yes	15.0	14.4	None	-	-	3.6	6.0	14.0				F
558	9-30L-F5	yes	17.5	4.8	3.9	7.0	9.5	4.2	7.5	9.3				F
559	6-30R-B3	Fired 1.1 sec. Before R_{max}	11.0	13.8	None	-	-	7.0	14.0	13.8				F
560	2-15R-C4	yes	18.0	9.0	3.75	6.0	9.4	5.1	10.5	9.0				S
561	10-30R-G5	yes	17.0	4.0	4.2	6.0	2.0	6.5	17.0	4.0				S
562	4-15R-E2	yes	16.0	1.5	3.9	6.5	5.2	4.7	10.0	4.2				S
563	1-15L-A4	Fired 1.8 sec. Before R_{max}	15.0	13.7	2.9	5.0	17.7	7.2	17.5	13.8				F
564	2-15R-C4	yes	18.0	9.5	3.75	6.0	9.0	6.5	18.0	9.5				S
565	5-15L-F5	Fired 3.7 sec. After R_{min}	16.5	4.4	4.1	7.0	2.6	1.7	3.0	2.0				F
566	8-30R-E2	yes	18.5	9.0	3.75	7.5	16.6	5.8	15.5	11.0				S
567a	6-30R-B3	Fired 14.9 sec Before R_{max}	10.5	12.7	None	-	-	13.0	36.0	20.0				F
567b	6-30R-B3	yes									5.7	9.5	12.4	F
568	3-15L-D3	Fired 0.7 sec. After R_{min}	18.0	10.4	3.9	7.5	8.3	3.5	6.0	8.0				F
569	9-30L-F5	yes	17.5	6.0	3.9	7.0	11.6	5.4	14.0	7.8				S
570	7-30L-D4	yes	15.0	16.0	2.9	5.0	15.2	5.5	11.5	14.8				F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 8.6

Results of Simulation

AOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max} True	E_R True	R_{min} (n.m.)	E_{max} True (deg)	E_R True (deg)	R(1)F (n.m.)	E_{max} True (deg)	E_R True (deg)	R(2)F (n.m.)	E_{max} True (deg)	E_2 True (deg)	
571	3-15L-D3	yes	18.0	11.5	4.0	7.5	11.4	6.5	18.0	11.5				S
572	9-30L-F5	yes	17.5	8.0	3.75	6.5	7.6	5.3	13.0	10.0				S
573	4-15R-E2	Fired 2.7 sec. After R_{min}	16.5	3.0	4.1	6.5	5.6	2.1	0.0	5.2				F
574	2-15R-C4	yes	17.5	9.0	3.75	5.5	7.0	4.6	8.0	7.4				S
575	5-15L-F5	Fired 2.0 sec. After R_{min}	16.5	3.6	4.1	7.0	3.0	1.75	1.5	1.5				F
576	8-30R-E2	yes	18.0	7.0	3.9	7.5	11.7	4.6	10.5	10.5				S
577	6-30R-B3	yes	11.0	13.3	None	-	-	6.0	10.0	13.0				F
578a	10-30R-G5	Fired 5.0 sec. Before R_{max}	17.0	8.0	4.1	6.0	7.6	9.5	28.5	4.0				F
578b	10-30R-G5	Fired 2.0 sec. After R_{min}									3.0	1.5	6.5	F
579	7-30L-D4	yes	15.0	11.6	3.1	4.0	11.4	4.8	9.0	9.7				F
580	1-15L-A4	Fired 0.7 sec. Before R_{max}	16.0	13.7	2.4	3.5	>20.0	6.75	16.5	14.0				F
581	7-30L-D4	yes	16.0	17.7	2.9	4.0	>20.0	6.0	13.5	17.5				F
582	10-30R-G5	Fired 3.5 sec. after R_{min}	18.0	3.7	4.1	7.5	4.0	2.1	1.0	2.7				F
583	1-15L-A4	yes	15.5	13.4	2.7	0.0	16.0	6.2	13.5	13.0				S
584	9-30L-F5	yes	18.0	7.8	3.9	8.0	15.0	5.7	15.0	9.5				S
585	3-15L-D3	yes	18.0	10.0	3.9	8.0	7.0	3.9	8.0	7.0				S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 8.7

Results of Simulation

AOJ Mode, Evaluation Set No. 2

Run No.	Code[1]	Missile Fired Between R_{max} & R_{min}	Data at R_{max}[4]		Data at R_{min}			Data for First Missile Firing			Data for Second Missile Firing			Evaluation[2]
			E_{max}[3] True	E_R True	R_{min} (n.m.)	E_{max} True (deg)	E_R True (deg)	R(1)F (n.m.)	E_{max} True (deg)	E_R True (deg)	R(2)F (n.m.)	E_{max} True (deg)	E_R True (deg)	
586	2-15R-C4	yes	18.5	9.3	3.75	7.0	9.7	5.6	14.0	9.7				S
587	8-30R-E2	yes	19.0	10.0	3.75	8.0	13.0	4.9	14.0	11.7				S
588	5-15L-F5	Fired 3.7 sec. After R_{min}	17.5	3.5	4.2	7.5	2.0	1.3	3.0	2.0				F
589	6-30R-B3	yes	11.0	13.5	None	-	-	5.9	9.5	13.4				F
590	4-15R-E2	Fired 1.7 sec. After R_{min}	17.5	2.4	4.1	7.5	6.3	3.0	3.5	7.0				F
591	2-15R-C4	yes	18.0	8.6	3.9	6.0	7.5	5.2	12.0	8.0				S
592	5-15L-F5	Fired 2.4 sec. After R_{min}	16.5	3.6	4.1	6.5	2.4	2.6	0.0	2.2				F
593	7-30L-D4	yes	14.5	12.0	3.0	3.5	9.6	4.6	8.5	9.2				F
594	9-30L-F5	yes	18.0	7.0	3.9	6.0	6.0	4.5	9.0	6.3				S
595	4-15R-E2	Fired 2.7 sec. After R_{min}	16.5	2.4	4.2	7.0	3.7	2.5	0.0	2.7				F
596	3-15L-D3	yes	18.0	9.4	3.9	7.5	7.5	4.9	11.5	8.2				S
597	10-30R-G5	yes	17.0	2.8	4.2	6.5	2.8	4.2	6.5	2.8				S
598a	1-15L-A4	Fired 5.9 sec. Before R_{max}	15.5	12.1	None	-	-	9.0	23.0	16.3				F
598b	1-15L-A4	yes									4.5	8.5	12.0	F
599	6-30R-B3	yes	11.0	14.8	None	-	-	6.5	11.0	14.8				F
600	8-30R-E2	yes	18.0	9.0	3.9	7.0	10.7	6.1	16.0	9.7				S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.
4. R_{max} Range = 6.5 n.m.

TABLE 9

Summary of Results

Attack-While-Search Mode
Deviated Pursuit, Lead Angle 10°
Set No. 1

Code	1-15R-A4	2-15L-C4	3-15R-D3	4-15L-E2	5-15R-F5	6-30L-B3	7-30R-D4	8-30L-E2	9-30R-F5	10-30L-G5	Totals
Successes	2	7	9	9	3		2	9	6	6	53
Failures Due to Launch Heading Errors	8	3		1	7	10	8	1	4	4	46
Failures Due to Firing Before R_{max}			1								1
Failures Due to Firing After R_{min}											
Failure to Fire When Permissible											
Total Runs Made	10	10	10	10	10	10	10	10	10	10	100
Potential Successes If Fired at R_{max}	2	10	10	10	6	1	4	10	7	8	68

Total No. Valid Runs = 100
Total No. Successes = 53
Total No. Potential Successes if Fired at R_{max} = 68

% Success = 53
% Potential Success = 68

TABLE 9.1

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
601	8-30L-E2	yes	6.5	16	1.5	4.0	6.5	7.8	5	11	4.8		S
602	1-15R-A4	yes	6.5	9.8	>20	None			5.4	8.5	>20		F
603	3-15R-D3	yes	6.5	15.8	5.8	4.1	7.0	12.5	5.0	12	8.5		S
604	2-15L-C4	yes	6.5	17	12.6	3.75	5.0	>20	5.0	10.5	17		F
605	10-30L-G5	yes	6.5	15	11.7	4.1	6.0	9.0	5.5	12.0	10.8		S
606	7-30R-D4	yes	6.5	13	>20	None			5.0	8.0	>20		F
607	5-15R-F5	yes	6.5	15	13.5	4.1	6.5	14.9	5.5	12	14.0		F
608	4-15L-E2	yes	6.5	15	10.8	4.25	6.0	10	5.0	10	10.0		S
609	9-30R-F5	yes	6.5	15.8	9.8	4.2	6.5	15.0	5.9	14	10.5		S
610	6-30L-B3	yes	6.5	10	>20	None			5.8	9	>20		F
611	4-15L-E2	yes	6.4	16	10.5	3.9	7.0	9.7	5.3	11	9.9		S
612	3-15R-D3	yes	6.5	17	2.8	4.1	7.0	5.0	4.5	10	4.0		S
613	2-15L-C4	yes	6.5	17	6.0	3.75	6.2	6.1	5.5	12	6.0		S
614	8-30L-E2	yes	6.5	18	8.0	4.0	8.0	11	5.0	12	8.5		S
615	7-30R-D4	yes	6.4	15	17.5	3.5	5.5	19.5	5.5	12	17.7		F
616	1-15R-A4	yes	6.5	10	>20	None			5.5	10	>20		F
617	10-30L-G5	yes	6.5	16	12.4	4.10	7.5	13.9	5.5	12.2	12.8		F
618	6-30L-B3	yes	6.5	10	>20	None			5.4	10	>20		F
619	9-30R-F5	yes	6.5	16.8	16.4	4.0	8.0	>20	5.8	14.2	18.2		F
620	5-15R-F5	yes	6.5	10.1	>20	None			5.7	10	>20		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 9.2

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
621	9-30R-F5	yes	6.5	16.5	8.0	4.1	7.8	14.7	5.5	14	9.3		S
622	10-30L-G5	yes	6.5	17.9	>20	3.9	6.0	>20	4.5	9.8	>20		F
623	4-15L-E2	yes	6.5	16.0	4.1	4.1	7.8	2.0	5.5	13.5	2.4		S
624	1-15R-A4	yes	6.5	14	18	None			5.6	13	>20		F
625	2-15L-C4	yes	6.4	18	11.2	3.75	6.5	13.6	5.4	14	10.9		S
626	3-15R-D3	yes	6.5	17	12.4	4.0	8.0	>20	5.5	15	15		S
627	7-30R-D4	yes	6.5	16	18.9	3.1	4.0	>20	5.6	14	>20		F
628	5-15R-F5	yes	6.5	17	>20	3.9	6.5	>20	4.5	10	>20		F
629	6-30L-B3	yes	6.5	11	>20	None			5.7	10	>20		F
630	8-30L-E2	yes	6.4	17.5	4.4	3.9	8.0	16.1	5.4	14	8.5		S
631	1-15R-A4	no	None			None			5.5	10	>20		F
632	2-15L-C4	yes	6.25	17.9	13	3.5	5.8	14.7	4.0	8.0	17.3		F
633	8-30L-E2	yes	6.3	17.8	11.4	3.6	7.0	>20	5.3	16	13.8		S
634	6-30L-B3	yes	6.3	10.2	>20	None			4.9	9.8	>20		F
635	5-15R-F5	yes	6.5	10.5	>20	None			5.0	9.7	>20		F
636	9-30R-F5	yes	6.4	17	15	3.6	8.0	16.5	5.4	13.8	16		F
637	3-15R-D3	yes	6.4	17	5.4	4.0	7.9	10.4	4.7	11	8.8		S
638	4-15L-E2	yes	6.5	16.5	11.2	4.1	7.5	13	5.0	11.6	11.6		S
639	10-30L-G5	yes	6.5	16.2	13.3	3.9	8.0	18.7	5.6	14.5	14		S
640	7-30R-D4	yes	6.5	14.2	18.2	3.5	6.0	>20	5.6	12.5	18.8		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 9.3

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{min} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
641	3-15R-D3	yes	6.5	17	7.2	4.1	8.0	14	5.4	13.8	9.9		S
642	9-30R-F5	yes	6.5	17	19.8	3.9	8.0	>20	5.6	14	>20		F
643	10-30L-G5	yes	6.5	16.8	19.6	4.0	7.9	18	5.6	14	18.8		F
644	1-15R-A4	yes	6.5	14.5	>20	None			5.2	10.5	>20		F
645	5-15R-F5	yes	6.5	16.5	3.8	4.3	8.0	15.1	5.6	14.5	14		S
646	8-30L-E2	yes	6.3	17.5	11.5	3.75	8.5	>20	5.4	15.5	14		S
647	2-15L-C4	yes	6.3	17.9	7.3	3.75	8.2	7.8	5.3	13	8.0		S
648	7-30R-D4	yes	6.5	14	>20	None			5.4	11.9	>20		F
649	6-30L-B3	yes	6.25	10.2	>20	None			5.5	9.5	>20		F
650	4-15L-E2	yes	6.5	16.5	13.6	4.0	4.5	11	4.5	9.0	11.2		F
651	8-30L-E2	yes	6.3	17	5.3	3.7	7.9	6.5	4.5	12.0	6.3		S
652	10-30L-G5	yes	6.3	16	5.6	3.9	7.0	5.4	5.0	13.0	5.2		S
653	3-15R-D3	yes	6.3	16.5	1.5	3.9	8.0	4.9	5.1	13	2.5		S
654	4-15L-E2	yes	6.25	16.5	6.8	3.9	7.8	6.6	4.8	12	6.7		S
655	7-30R-D4	yes	6.25	14.2	9.8	2.8	4.2	10.8	5.3	12.2	9.9		S
656	5-15R-F5	yes	6.3	11.8	10.5	None			4.9	8.2	10.6		F
657	1-15R-A4	yes	6.25	14.5	8.0	2.6	5.0	15.6	5.4	12.5	8.0		S
658	9-30R-F5	yes	6.3	16.5	3.7	3.9	7.5	3.5	4.5	11.0	3.0		S
659	6-30L-B3	yes	6.5	10.5	10.1	None			5.2	8.2	9.9		F
660	2-15L-C4	yes	6.25	17.5	5.2	3.6	5.9	4.5	4.0	8.5	4.8		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 9.4

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
661	10-30L-G5	yes	6.25	16.5	3.5	3.9	8.0	3.1	4.8	12.5	3.2		S
662	4-15L-E2	yes	6.3	16.5	4.4	4.0	7.5	2.9	5.4	13.5	3.8		S
663	1-15R-A4	yes	6.2	11.0	>20	None			5.0	8.0	>20		F
664	2-15L-C4	yes	6.25	17.5	3.7	3.25	6.0	3.0	4.6	10	3.0		S
665	5-15R-F5	yes	6.25	16	5.2	3.9	8.0	7.7	5.5	14.5	5.5		S
666	8-30L-E2	yes	6.3	18	4.8	3.75	6.5	16.5	4.3	10.0	14.2		F
667	6-30L-B3	yes	6.3	11	>20	None			5.5	9.0	>20		F
668	3-15R-D3	yes	6.25	17.2	7.8	3.8	8.0	4.8	4.7	12.0	6.1		S
669	9-30R-F5	yes	6.3	16.5	8.6	3.9	7.5	10.2	4.5	11.0	9.1		S
670	7-30R-D4	yes	6.3	15	>20	3.1	4.0	>20	3.6	8.0	>20		F
671	3-15R-D3	yes	6.3	17	4.8	4.0	8.0	10	5.3	13.0	6.9		S
672	9-30R-F5	yes	6.4	17.5	17.0	4.0	8.0	15	5.4	13	15.5		F
673	4-15L-E2	yes	6.25	16.5	8.6	4.0	7.5	4.9	4.7	11	6.0		S
674	2-15L-C4	yes	6.25	17.5	12.9	3.5	6.5	11.7	5.3	14.2	12.0		S
675	5-15R-F5	yes	6.25	16.5	8.0	3.9	7.0	13.1	4.7	10.2	10.2		S
676	8-30L-E2	yes	6.3	17.5	3.4	3.75	8.0	17	5.2	13.0	8.9		S
677	6-30L-B3	yes	6.4	10.5	>20	None			5.4	9.5	>20		F
678	10-30L-G5	yes	6.25	16.2	10.2	3.9	7.0	10.3	4.7	10.2	9.8		S
679	7-30R-D4	yes	6.4	14	10.1	3.6	5.5	>20	4.5	9.8	11.2		F
680	1-15R-A4	yes	6.5	15	>20	None			4.6	8.0	>20		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 9.5

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
681	7-30R-D4	yes	6.5	14	8.3	3.5	5.8	>20	4.8	10	7.8		S
682	10-30L-G5	yes	6.25	16.5	10.9	3.8	7.8	17	4.5	10.5	14.2		F
683	1-15R-A4	yes	6.3	10.2	>20	None			5.8	10.2	>20		F
684	9-30R-F5	yes	6.3	17.	2.5	3.9	7.8	4.1	4.8	12	2.0		S
685	3-15R-D3	yes	6.3	17	4.4	3.9	8.0	9.6	5.3	13.5	6.2		S
686	2-15L-C4	yes	6.4	18	6.5	3.75	8.0	19.5	5.2	14	11.5		S
687	8-30L-E2	yes	6.3	18	4.3	3.8	8.0	14.5	5.0	12	9.5		S
688	5-15R-F5	yes	6.3	16.2	13.8	4.0	8.0	>20	5.1	12.2	16		F
689	6-30L-B3	yes	6.3	11.0	>20	None			4.5	9.0	>20		F
690	4-15L-E2	yes	6.3	17.0	11.5	4.0	7.5	9.3	5.0	11.0	10		S
691	2-15L-C4	yes	6.3	18	10.5	3.75	7.8		5.3	14.5	15.1		F
692	5-15R-F5	yes	6.25	8.5	16.5	3.8	8.0	16.8	5.3	14	16.5		F
693	7-30R-D4	yes	6.3	15	13.9	3.4	5.8	13.2	5.3	11	13		F
694	9-30R-F5	yes	6.3	17	13	3.9	7.5	9.2	5.1	12.5	10.9		S
695	4-15L-E2	yes	6.25	16.2	8.2	4.1	7.8	11.6	5.5	14.2	8.7		S
696	3-15R-D3	no	6.30	17	3.3	3.8	8.0	3.1	2.8	6.0	3.0	Fired 1.2 sec After R_{min}	F
697	10-30L-G5	yes	6.25	16	1.6	3.8	7.0	2.5	5.2	13	.7		S
698	1-15R-A4	yes	6.4	14.5	.8	2.5	4.5	9.6	4.5	7.0	3.8		S
699	6-30L-B3	yes	6.4	11.0	>20	None			5.3	9.0	>20		F
700	8-30L-E2	yes	6.3	17	6.9	3.75	8.0	13.9	5.2	12.5	10.5		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 10

Summary of Results

Attack-While-Search Mode
Deviated Pursuit, Lead Angle 10°
Set No. 2

Code	1-15L-A4	2-15R-C4	3-15L-D3	4-15R-E2	5-15L-F5	6-30R-B3	7-30L-D4	8-30R-E3	9-30L-F5	10-30R-G5	Totals
Successes		5	7	3	1			5	4	6	31
Failures Due to Launch Heading Errors	10	5	3	5	9	10	10	5	4	2	63
Failures Due to Firing Before R_{max}									1	1	2
Failures Due to Firing After R_{min}				2							2
Failure to Fire When Permissible									1	1	2
Total Runs Made	10	10	10	10	10	10	10	10	10	10	100
Potential Successes if Fired at R_{max}		4	9	8	3		1	8	10	10	53

Total No. Valid Runs = 100
Total No. Successes = 31
Total No. Potential Successes if Fired at R_{max} = 53

Percent Success = 31
Percent Potential Success = 53

TABLE 10.1

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
701	8-30R-E2	yes	6.5	17.5	9	3.9	7.5	>20	6.5	17.5	9		S
702	1-15L-A4	yes	6.5	13	>20	3.5	10	>20	6	12	>20		F
703	3-15L-D3	yes	6.5	17	7	4.1	7.5	15	4.5	9	14		F
704	2-14R-C4	yes	6.5	16	>20	None			5.5	11.5	>20		F
705	10-30R-G5	yes	6.5	16	13	4	7	13	5.5	11.5	13		F
706	7-30L-D4	yes	6.5	10	>20	3.7	10	>20	6.5	10	>20		F
707	5-15L-F5	yes	6.5	17	>20	3.8	8	>20	5.5	14.5	>20		F
708	4-15R-E2	yes	6.5	17	14	4	7.5	11.5	5.2	11.5	13		F
709	9-30L-F5	yes	6.5	16.5	13.5	3.8	7	>20	3.8	7	>20		F
710	6-30R-B3	yes	6.5	10	>20	None			5.5	8	>20		F
711	4-15R-E2	no	6.5	16.5	12.5	4			3.7	6.5	11	Fired 0.4 sec After R_{min}	F
712	3-15L-D3	yes	6.5	17	5.5	4	8	10.5	5.5	12	7.5		S
713	2-15R-C4	yes	6.5	17	15	4	6	16.5	6.25	16	15		S
714	8-30R-E2	yes	6.5	17	11	4.1	7.5	>20	6	15.5	13.5		S
715	7-30L-D4	yes	6.5	14	>20	3.25	4	>20	5.5	10	>20		F
716	1-15L-A4	yes	6.5	10.5	>20	None			5.5	9.5	>20		F
717	10-30R-G5	yes	6.5	15.5	3	4	7	7.5	6.5	15.5	3		S
718	6-30R-B3	yes	6.5	10	>20	None			5.5	10	>20		F
719	9-30L-F5	yes	6.5	16.5	14.5	3.75	7	>20	5.8	14	16		F
720	5-15L-F5	yes	6.5	16.5	19	4.2	7	19	6	13.5	19		F
721	9-30L-F5	yes	6.5	16	14	3.8	7	>20	6.5	16	14		S
722	10-30R-G5	yes	6.5	16.5	16	4	7	>20	5.25	11.5	18		F
723	4-15R-E2	yes	6.5	16	8	4.25	7.5	6	6	14	7.5		S
724	1-15L-A4	yes	6.5	13	>20	None			5.8	9	>20		F
725	2-15R-C4	yes	6.5	16	>20	3.6	6	19.5	5.2	10	19.5		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 10.2

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 2

Run No.	Code	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
726	3-15L-D3	yes	6.5	16.5	9	4	8	18	5	11.5	13		F
727	7-30L-D4	yes	6.5	14	>20	None			6.0	12.5	>20		F
728	5-15L-F5	yes	6.5	15.5	13	4	7	15.5	5	10	14		F
729	6-30R-B3	yes	6.5	10	>20	None			5.8	10	> 0		F
730	8-30R-E2	no	6.5	17	17	3.75	6	>20	None				F
731	1-15L-A4	no	None			None			6.5	10	>20		F
732	2-15R-C4	yes	6.5	15.5	>20	None			4	7	>20		F
733	8-30R-E2	yes	6.5	17	1.5	4	7.5	7.5	5	11.5	4		S
734	6-30R-B3	yes	6.5	10.5	>20	None			6.5	10.5	>20		F
735	5-15L-F5	yes	6.5	16.5	>20	4.1	8	>20	5.3	11.5	>20		F
736	9-30L-F5	yes	6.5	16.5	11	3.75	7.5	>20	5	11	16.5		F
737	3-15L-D3	yes	6.5	17	5.5	3.9	8	12	5.5	13.5	7.5		S
738	4-15R-E2	yes	6.5	16.5	9.5	4	6	7.5	4.5	9.5	8.5		S
739	10-30R-G5	yes	6.5	16	7.5	4	7	9.5	6.5	16	7.5		S
740	7-30L-D4	no	6.3	14	>20	None			None				F
741	3-15L-D3	yes	6.5	17	6	4	8	14.5	5.9	14	8.5		S
742	9-30L-F5	no	6.5	16	2	4	7.5	8.5	6.8	18	1	Fired 0.5 sec Before R_{max}	F
743	10-30R-G5	no	6.5	16	2	4.2	7	1.5	7.5	>20	2.5	Fired 1.8 sec Before R_{max}	F
744	1-15L-A4	no	None			None			5.5	4	>20		F
745	5-15L-F5	yes	6.5	16	7.5	4	7	7	5.25	10.5	7		S
746	8-30R-E2	yes	6.5	17.5	14	3.8	7.5	>20	5.2	12	>20		F
747	2-15R-C4	yes	6.5	17	8	3.7	6	7.5	4.5	9	7		S
748	7-30L-D4	yes	6.5	14	>20	None			5	10	>20		F
749	6-30R-B3	yes	6.5	10	>20	None			5.5	9	>20		F
750	4-15R-E2	yes	6.5	16	10	4.2	7	10.5	4.2	7	10.5		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 10.3

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
751	8-30R-E2	yes	6.5	17.5	9.5	4	7.5	>20	4.5	10	17.5		F
752	10-30R-G5	no	6.5	16.5	11	4	8	>20	None			Could Have Fired	F
753	3-15L-D3	yes	6.5	17	2	4.25	8	4.5	5	11	4		S
754	4-15R-E2	yes	6.5	17	17	3.75	7.5	17	4.7	11	17		F
755	7-30L-D4	no	6.5	15	>20	3.25	5	>20	6.9	18	>20	Fired 0.5 sec. Before R_{max}	F
756	5-15L-F5	yes	6.5	17	>20	3.8	8	>20	4.5	10.5	>20		F
757	1-15L-A4	no	None			None			5.5	8	>20		F
758	9-30L-F5	no	6.5	16.5	12	3.9	7.5	>20	None			Could Have Fired	F
759	6-30R-B3	yes	6.5	10	>20	None			5.5	9.5	>20		S
760	2-15R-C4	yes	6.5	16.5	15.5	3.6	6	13	6.25	15	15		S
761	10-30R-G5	yes	6.5	16	6	3.9	7	8	6.5	16	6		S
762	4-15R-E2	yes	6.5	16	1.5	4	7	4	5.2	11	2		F
763	1-15L-A4	yes	6.3	10.5	>20	None			5.5	6	>20		F
764	2-15R-C4	yes	6.5	17	17	3.5	5	20	4.5	8	15.5		F
765	5-15L-F5	yes	6.5	16	>20	3.75	7	>20	5.5	12	>20		F
766	8-30R-E2	yes	6.5	17	15	3.7	7	>20	4	8	>20		F
767	6-30R-B3	yes	6.5	12	19.5	None			6.5	12	19.5		F
768	3-15L-D3	no	None			None			5.5	4	>20		F
769	9-30L-F5	yes	6.5	17	13.5	4	7	9	5.2	11.5	11		S
770	7-30L-D4	yes	6.5	16	7.5	3.7	6	>20	5	10	14		F
771	3-15L-D3	yes	6.5	17	11	3.6	8	11.5	5.2	13	12		S
772	9-30L-F5	yes	6.5	16.5	9.5	3.6	6	11	4	9	10.5		F
773	4-15R-E2	yes	6.5	16.5	>20	3.8	7	>20	3.8	7	>20		F
774	2-15R-C4	yes	6.5	16.5	5.5	3.7	6	5	4.5	9	4.5		S
775	5-15L-F5	yes	6.5	16	17.5	3.9	7.5	17.5	5.2	11.5	17		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 10.4

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 10°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
776	8-30R-E2	no	6.5	17	16.5	3.6	7	>20	None				F
777	6-30R-B3	yes	6.5	10	>20	None			4.5	6.5	>20		F
778	10-30R-G5	yes	6.5	16	3.5	3.6	5	5	4	8	4.5		S
779	7-30L-D4	yes	6.5	14	>20	2.7	3	>20	6	12	>20		F
780	1-15L-A4	no	None			None			5	3.5	>20		F
781	7-30L-D4	yes	6.5	16	>20	None			5	10.5	>20		F
782	10-30R-G5	yes	6.5	16	8	3.8	7	11	4.8	10.5	10		S
783	1-15L-A4	no	None			None			6	9.5	>20		F
784	9-30L-F5	yes	6.5	16	5	4.1	7.5	6.5	5	11.5	3.5		S
785	3-15L-D3	yes	6.5	17	4.5	4	7.5	10.5	4.8	11	7.5		S
786	2-15R-C4	yes	6.5	18	8	3.9	6	11	4.8	11	10.5		S
787	8-30R-E2	yes	6.5	17	6.5	3.9	8	16	4.8	11.5	11.5		S
788	5-15L-F5	yes	6.5	16	>20	3.9	7	>20	4.5	9	>20		F
789	6-30R-B3	yes	6.5	10	>20	None			5	9	>20		F
790	4-15R-E2	yes	6.5	16	13.5	3.9	6	9.5	4.5	9.5	10.5		F
791	2-15R-C4	yes	6.5	15.5	>20	None			3.5	6	>20		F
792	5-15L-F5	yes	6.5	15.5	13	4	7	13.5	5.5	12	13		F
793	7-30L-D4	yes	6.5	14	20	None			5.5	10.5	>20		F
794	9-30L-F5	yes	6.5	16	1.5	4	6.5	11.5	6.5	16	1.5		S
795	4-15R-E2	no	6.5	16.5	14.5	4.2	7.5	11.5	3.7	5.5	11	Fired 0.5 sec. After R_{min}	F
796	3-15L-D3	yes	6.5	17	5	4	7	11.5	4.7	10.5	8.5		S
797	10-30R-G5	yes	6.5	16	8	4	7	6	6.5	16	8		S
798	1-15L-A4	no	None			None			None				F
799	6-30R-B3	yes	6.5	11.5	>20	None			5.5	8	>20		F
800	8-30R-E2	yes	6.5	17.	5.5	4	8.	16.5	5.2	12	9.5		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 11

Summary of Results

Attack-While-Search Mode
Deviated Pursuit, Lead Angle 18°
Set No. I

Code	1-15R-A4	2-15L-C4	3-15R-D3	4-15L-E2	5-15R-F5	6-30L-B3	7-30R-D4	8-30L-E2	9-30R-F5	10-30-G5	Totals
Successes	5	8	9	6	1	1	7	8	8	6	59
Failures Due to Launch Heading Errors	4	2	1	4	9	9	3		2	4	38
Failures Due to Firing Before R_{max}	1										1
Failures Due to Firing After R_{min}											
Failure to Fire When Permissible								1			1
Total Runs Made	10	10	10	10	10	10	10	9*	10	10	99
Potential Successes If Fired at R_{max}	7	9	10	7	2	4	8	9	10	6	72

Total No. *Valid Runs* = 99
Total No. Successes = 59

Total No. Potential Successes if Fired at R_{max} = 72
% Success = 59.6
% Potential Success = 72.8

* One Run of 8-30L-E2 was Incomplete.

TABLE 11.1

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
801	8-30L-E2	yes	6.5	18	5.6	4.0	7.8	4.8	4.6	11.5	3.1		S
802	1-15R-A4	yes	6.4	15	4.2	3.25	5.0	>20	4.7	10.5	9.5		S
803	3-15R-D3	yes	6.4	18	7.9	3.8	9.0	16.5	5.1	14	11.8		S
804	2-15L-C4	yes	6.3	18.5	3.7	3.75	9.0	6.5	5.2	16	3.9		S
805	10-30L-G5	yes	6.5	18	18.5	4.0	8.0	19.7	4.8	12	18.6		F
806	7-30R-D4	yes	6.5	16.5	2.5	3.75	8.0	7.0	5.5	14	0.8		S
807	5-15R-F5	yes	6.5	18.5	>20	3.5	8.5	>20	4.8	12.5	>20		F
808	4-15L-E2	yes	6.5	17	13	4.0	8.5	10	5.2	13.8	9.8		S
809	9-30R-F5	yes	6.5	18	13	4.0	8.0	9.5	4.9	12.5	10.8		S
810	6-30L-B3	yes	6.5	12.5	>20	None			4.7	9.5	>20		F
811	4-15L-E2	yes	6.5	17.5	19	3.9	8.0	>20	5.3	14	>20		F
812	3-15R-D3	yes	6.5	18	11.5	4.0	8.0	13.9	4.8	12	13		F
813	2-15L-C4	yes	6.4	17.5	7.2	3.8	4.0	7.5	4.7	12	5.2		S
814	8-30L-E2	yes	6.5	18	3.1	3.8	8.0	11.9	5.6	16	3.7		S
815	7-30R-D4	yes	6.5	15	8.0	3.6	6.0	7.0	5.7	14	7.1		S
816	1-15R-A4	no	6.5	12	10.2	None			7.9	18.5	14	Fired 3.6 sec. Before R_{max}	F
817	10-30L-G5	yes	6.5	16.5	13.3	3.8	7.5	18	5.4	14	13.5		S
818	6-30L-B3	yes	6.4	12	8.5	None			5.4	9	9.5		F
819	9-30R-F5	yes	6.5	17	1.0	4.0	6.5	4.8	4.7	10	3.5		S
820	5-15R-F5	yes	6.5	13.5	12	None			4.9	7.9	13.5		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 11.2

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
821	9-30R-F5	yes	6.5	17	13	4.0	7.8	15.2	5.4	3.2	13.2		S
822	10-30L-G5	yes	6.5	17	14.8	4.1	8.0	13	5.5	14	14		S
823	4-15L-E2	yes	6.5	17	9.5	4.0	7.8	10.6	4.9	11	9.9		S
824	1-15R-A4	no	None			None			None			Did Not Fire	F
825	2-15L-C4	yes	6.4	17.5	3.4	3.8	8.0	10.8	5.4	16	2.3		S
826	3-15R-D3	yes	6.5	18	12.5	4.0	7.5	7.5	4.6	10.5	9.0		S
827	7-30R-D4	yes	6.5	15.5	10	2.6	6.0	9.1	4.7	9.5	8		S
828	5-15R-F5	yes	6.5	17	19.8	4.0	8.5	>20	5.4	14	>20		F
829	6-30L-B3	yes	6.5	11.5	>20	None			5.6	10	>20		F
830	8-30L-E2	yes	6.5	18	2.0	3.9	8.5	8.4	5.7	16	3.5		S
831	1-15R-A4	yes	6.5	14.5	4.5	3.4	5.5	>20	5.6	12	7.0		S
832	2-15L-C4	yes	6.4	18	1.5	3.7	7.8	>20	4.5	12	14.2		F
833	8-30L-E2	yes	6.3	18	3.3	3.9	8.0	7.0	4.5	11	5		S
834	6-30L-B3	yes	6.3	13.5	14.9	None			5.5	12.2	15.2		F
835	5-15R-F5	yes	6.5	16.2	15.4	3.8	8.0	>20	5.7	15.5	17		F
836	9-30R-F5	yes	6.5	17.2	14.2	3.8	8.0	11.3	5.7	16	13.8		S
837	3-15R-D3	yes	6.4	17	2.0	4.0	8.0	1.0	5.2	13.5	1.0		S
838	4-15L-E2	yes	6.5	17.5	17	3.8	8.0	>20	5.5	14	17.9		F
839	10-30L-G5	yes	6.5	17.5	19.4	3.75	8.0	>20	5.7	16	19.8		F
840	7-30R-D4	yes	6.5	10.2	6.0	3.6	6.0	14.5	5.6	13.5	10.3		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 11.3

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
841	3-15R-D3	yes	6.5	17	1.0	4.0	8.5	4.5	5.5	16.5	1.1		S
842	9-30R-F5	yes	6.5	17.5	14.5	4.1	8.0	11.5	5.5	15	13.5		S
843	10-30L-G5	yes	6.5	16.5	10	4.1	8.0	16	5.1	12.5	11.5		S
844	1-15R-A4	yes	6.5	14.2	10.5	None			5.6	14	11.5		S
845	5-15R-F5	yes	6.5	18	>20	3.7	7.5	>20	5.4	15.5	>20		F
846	8-30L-E2	yes	6.5	18	8.8	4.0	8.5	2.6	5.3	14	6.5		S
847	2-15L-C4	yes	6.4	16.5	5.8	3.8	7.8	6.0	4.6	10.5	6.5		S
848	7-30R-D4	yes	6.4	17	11.8	6.25	6.5	15.1	5.1	13	12.8		S
849	6-30L-B3	yes	6.3	12	14.1	None			6.3	12	14.1	Fired at R_{max}	F
850	4-15L-E2	yes	6.5	17	11.2	4.0	6.0		4.5	10	10		S
851	8-30L-E2	yes	6.3	17.5	8.5	3.75	8.0	16.8	5.5	15.5	10.5		S
852	10-30L-G5	yes	6.3	16.5	10.8	3.75	7.0	10.9	4.5	10.5	9.8		S
853	3-15R-D3	yes	6.4	17.5	0.2	3.9	8.2	2.7	5.4	14.5	0.8		S
854	4-15L-E2	yes	6.5	17	12.7	4.0	6.2	12.6	4.6	10	12.3		F
855	7-30R-D4	yes	6.5	14.5	19	3.25	5.5	>20	5.3	11.8	19		F
856	5-15R-F5	yes	6.4	18	>20	3.75	8.5	>20	5.2	14	>20		F
857	1-15R-A4	yes	6.5	14.5	10.5	3.0	4.0	>20	5.0	11	16.5		F
858	9-30R-F5	yes	6.5	17	7.9	4.0	8.0	6.7	5.6	14	7.0		S
859	6-30L-B3	yes	6.4	11.5	17.2	None			5.6	10	17.6		F
860	2-15L-C4	no	6.4	18	1.6	3.8	8.5	11.5	6.5	18.5	1.6	Fired 0.3 sec. Before R_{max}	S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 11.4

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max} (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
861	10-30L-G5	yes	6.5	17	20	4.0	8.0	>20	5.6	15.5	>20		F
862	4-15L-E2	yes	6.5	17	13.4	3.8	8.0	12	5.7	14.5	13		S
863	1-15R-A4	yes	6.5	14.5	7.8	3.3	5.5	17.2	5.6	14	8.0		S
864	2-15L-C4	no	6.4	14.0	18.4	3.75	8.0	14	2.7	5.0	14	Fired 1.2 sec. After R_{min}	F
865	5-15R-F5	yes	6.5	18	>20	3.75	8.5	>20	5.5	15	>20		F
866	8-30L-E2	yes	6.5	17.8	4.5	3.8	8.0	15.5	5.5	14.5	6.6		S
867	6-30L-B3	yes	6.5	12.5	11.8	None			5.5	9.0	12.5		F
868	3-15R-D3	yes	6.5	17.5	10.5	3.9	8.0	13.2	4.8	12	12		S
869	9-30R-F5	yes	6.5	17.5	13	4.0	8.0	15	5.2	12.5	14		F
870	7-30R-D4	yes	6.4	16	14.5	3.6	6.0	17.8	5.0	12	12.8		F
871	3-15R-D3	yes	6.5	17.8	5.0	4.0	8.5	10	5.3	13.5	7.5		S
872	9-30R-F5	yes	6.5	17	3.9	4.1	8.0	2.9	5.0	12.5	1.9		S
873	4-15L-E2	yes	6.5	17	14.2	3.9	6.0	17.7	4.4	10	16.8		F
874	2-15L-C4	no	6.5	11.5	11.5	4.0	7.0	14.2	6.7	15.5	12	Fired 0.3 sec. Before R_{max}	S
875	5-15R-F5	yes	6.5	17	16	4.0	8.0	>20	6.5	17	16	Fired at R_{max}	S
876	8-30L-E2	yes	6.5	18	4.5	4.0	8.5	14	5.3	14	8.5		S
877	6-30L-B3	yes	6.5	11	14.9	None			5.9	10	14		F
878	10-30L-G5	yes	6.5	17.5	12	3.9	8.0	18	6.5	17.5	12	Fired at R_{max}	S
879	7-30R-D4	yes	6.5	17.5	11.5	3.75	7.0	14.5	5.4	14	13		S
880	1-15R-A4	yes	6.5	14.5	9.5	3.2	4.0	13	5.8	14	11		S

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 11.5

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max} (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
881	7-30R-D4	yes	6.4	16	6.4	3.75	6.5	10.2	5.2	11.5	7.9		S
882	10-30L-G5	yes	6.3	16	13	3.9	7.5	10	5.3	15.5	12.7		S
883	1-15R-A4	no	6.5	12	15	3.25	4	9.5	None			Did Not Fire	F
884	9-30R-F5	yes	6.5	17	11.1	3.9	8.0	16	5.1	12	12.8		F
885	3-15R-D3	yes	6.4	17	1.0	4.0	7.8	6.2	5.0	13	3.2		S
886	2-15L-C4	yes	6.5	14.5	13.9	3.8	7.8	8.5	5.3	13.5	12.6		S
887	8-30L-E2	no	6.5	17.5	7.8	3.75	8.5	15.2	None			Did Not Fire	F
888	5-15R-F5	yes	6.5	16.5	>20	4.0	8.0	>20	5.2	12.5	>20		F
889	6-30L-B3	yes	6.5	10.5	15	None			5.6	10	15		F
890	4-15L-E2	yes	6.5	16	9.0	4.1	7.8	8.3	5.4	14	8.8		S
891	2-15L-C4	yes	6.4	18	3.9	3.8	8.0	13.8	4.9	13	7.3		S
892	5-15R-F5	yes	6.5	16.5	>20	3.9	8.0	>20	5.5	15.5	>20		F
893	7-30R-D4	yes	6.4	15	15.5	3.5	6.0	18	5.5	13	15.2		F
894	9-30R-F5	yes	6.5	16.5	11	4.0	7.5	12.8	5.5	14	11.2		S
895	4-15L-E2	yes	6.5	16.5	13.5	4.0	8.0	12	5.4	12.6	12.6		S
896	3-15R-D3	yes	6.5	17	2.5	4.0	8.0	4.7	5.4	14	3.4		S
897	10-30L-G5	yes	6.5	17.5	>20	3.75	8.0	>20	5.4	16	>20		F
898	1-15R-A4	no	None			None			6.0	17	>20		F
899	6-30L-B3	yes	6.4	12	6.7	1.75	5.5	>20	5.3	9.5	7.8		S
900	8-30L-E2												I

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 12

Summary of Results

Attack-While-Search Mode
Deviated Pursuit, Lead Angle 18°
Set No. 2

Code	1-15L-A4	2-15R-C4	3-15L-D3	4-15R-E2	5-15L-F5	6-30R-B3	7-30L-D4	8-30R-E2	9-30L-F5	10-30R-G5	Totals
Successes		6	4		1	1	2	5	3		22
Failures Due to Launch Heading Errors	10	4	3	9	8	7	8	2	7	10	68
Failures Due to Firing Before R_{max}											
Failures Due to Firing After R_{min}			3	1	1			3			8
Failure to Fire When Permissible						2					2
Total Runs Made	10	10	10	10	10	10	10	10	10	10	100
Potential Successes If Fired at R_{max}		6	10	2	2	6	3	10	7	3	49

Total No. Valid Runs = 100
Total No. Successes = 22
Total No. Potential Successes = 49

Percent Success = 22
Percent Potential Success = 49

TABLE 12.1

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
901	8-30R-E2	yes	6.5	18	12.5	4.1	8	9	4.2	9	9		S
902	1-15L-A4	no	None			None			5.5	10	>20		F
903	3-15L-D3	no	6.5	17	4.5	4	8	8.5	3.6	6.5	9	Fired 0.6 sec. After R_{min}	F
904	2-15R-C4	yes	6.5	17	9	3.8	7	7.5	4	8	7.5		S
905	10-30R-G5	yes	6.5	17.5	>20	4.	6	>20	5.5	14.5	>20		F
906	7-30L-D4	yes	6.5	15.5	6	3.8	6	16.5	4.5	9.5	11.5		F
907	5-15L-F5	yes	6.5	17	>20	3.9	8	>20	4.5	10.5	>20		F
908	4-15R-E2	no	6.5	17	>20	4	8	20	3.6	6.5	19.5	Fired 0.6 sec. After R_{min}	F
909	9-30L-F5	yes	6.5	17	13	4	7	12.5	4.5	10.5	12		F
910	6-30R-B3	no	6.5	12	6	2.75	5.5	>20	None			Could Have Fired	F
911	4-15R-E2	yes	6.5	17	18	3.9	7	>20	4.1	9.5	>20		F
912	3-15L-D3	yes	6.5	17.5	7.5	3.75	8	13.5	4.5	12.5	10.5		S
913	2-15R-C4	yes	6.5	18	7.5	3.9	8	18.5	5.4	14	11		S
914	8-30R-E2	yes	6.5	17	5	4	8	8.5	4.6	12	7		S
915	7-30L-D4	yes	6.5	14.5	19	3.2	5	>20	5	10	19		F
916	1-15L-A4	no	None			None			5.5	26	>20		F
917	10-30R-G5	no	6.5	17	>20	3.75	7	>20	7	20	>20	Fired 1.1 sec. Before R_{max}	F
918	6-30R-B3	yes	6.5	11.5	>20	None			4.5	8	>20		F
919	9-30L-F5	yes	6.5	16.5	19	3.75	6.5	>20	5.3	12.5	>20		F
920	5-15L-F5	yes	6.5	16.5	>20	3.6	6.5	>20	4.5	11	20		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 12.2

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
921	9-30L-F5	yes	6.5	17	11	3.9	7	11.5	4.2	9	11		F
922	10-30R-G5	yes	6.5	17	13	4	7	14.5	4.1	8	14		F
923	4-15R-E2	yes	6.5	17	17.5	4	8	16	5.5	14	17		F
924	1-15L-A4	no	None			None			5	13.5	>20		F
925	2-15R-C4	yes	6.5	17	16	3.75	6	14.5	4	8	14		F
926	3-15L-D3	yes	6.5	17.5	14.5	3.8	8	>20	5.5	13.5	16.5		F
927	7-30L-D4	yes	6.5	17	16	3.5	5.5	>20	3.5	5.5	>20		F
928	5-15L-F5	yes	6.5	17	>20	3.9	8	>20	4.6	8	>20		F
929	6-30R-B3	yes	6.5	11	>20	None			4.7	8	>20		F
930	8-30R-E2	no	6.5	17	4	4	8	8.5	2.8	5	9	Fired 1.1 sec. After R_{min}	F
931	1-15L-A4	no	None			None			5	13	>20		F
932	2-15R-C4	yes	6.5	16	2.5	3.6	6	4.5	5.5	13	2.5		S
933	8-30R-E2	yes	6.5	17	5.5	3.8	6	13.5	4.3	9.5	11.5		F
934	6-30R-B3	yes	6.5	12	16.5	None			5.5	8	17.5		F
935	5-15L-F5	no	6.5	17	18.5	3.8	7	>20	3.2	4.5	>20	Fired 1.5 sec. After R_{min}	F
936	9-30L-F5	yes	6.5	16	8	3.9	7	13.5	4.6	10	11.5		F
937	3-15L-D3	yes	6.5	16.5	2.5	4	6	5.5	4.5	9.5	3.5		S
938	4-15R-E2	no	6.5	15.5	5.5	4	7	5	3.0	4.5	4.5	Fired 1.0 sec. After R_{min}	F
939	10-30R-G5	yes	6.5	16.5	8.5	4	6	9.5	4.1	8	9		F
940	7-30L-D4	yes	6.5	13.5	>20	None			3	5	>20		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 12.3

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	ER (deg)	R_{min} (n.m.)	E_{max} (deg)	ER (deg)	R_{Fire} (n.m.)	E_{max} (deg)	ER (deg)		
941	3-15L-D3	no	6.5	17.5	4.5	3.8	9	12	3.6	8	13	Fired 0.5 sec. After R_{min}	F
942	9-30L-F5	yes	6.5	18	20	3.7	9	>20	5.2	12.5	>20		F
943	10-30R-G5	yes	6.5	17	11.5	3.9	7	8	3.9	7	8		F
944	1-15L-A4	no	None			None			6.2	6.5	>20		F
945	5-15L-F5	no	6.5	16.5	11.5	4	8	17.5	3.5	5.5	20	Fired 1.0 sec. After R_{min}	F
946	8-30R-E2	yes	6.5	18	12.5	4	8	11	4.1	9.5	11		F
947	2-15R-C4	yes	6.5	18	5.5	3.75	8	7.5	6	16	6		S
948	7-30L-D4	yes	6.5	16	11.5	3.6	6	9.5	5.5	12	10		S
949	6-30R-B3	yes	6.5	13	12.5	None			5.2	8	15.5		F
950	4-15R-E2	no	6.5	17	18	3.9	8.5	19.5	3.5	8	20	Fired 0.4 sec. After R_{min}	F
951	8-30R-E2	yes	6.5	18	10	3.9	8.5	7.5	5	12	8		S
952	10-30R-G5	yes	6.5	17	18.5	3.75	8	>20	4.5	10	20		F
953	3-15L-D3	yes	6.5	17	8	3.75	8	14.5	3.75	8	14.5		F
954	4-15R-E2	yes	6.5	18	18.5	3.75	8	>20	4.8	12	>20		F
955	7-30L-D4	yes	6.4	15	>20	3.2	5	>20	4	7.5	>20		F
956	5-15L-F5	yes	6.5	17	19.5	3.8	8	>20	5	11	>20		F
957	1-15L-A4	yes	6.4	14.5	>20	None			4.6	8	>20		F
958	9-30L-F5	yes	6.5	18	7.5	3.9	8	4	6.5	18	7.5		S
959	6-30R-B3	yes	6.5	13	14.5	None			5	8	19.5		F
960	2-15R-C4	no	6.5	15	>20	None			None				F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 12.4

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
961	10-30R-G5	yes	6.5	18	20	3.75	8	>20	3.9	9	>20		F
962	4-15R-E2	yes	6.5	18	>20	3.75	7.5	>20	4.25	10	>20		F
963	1-15L-A4	no	None			None			None				F
964	2-15R-C4	yes	6.5	17.5	4	3.5	7	4	5.2	12.5	3		S
965	5-15L-F5	yes	6.5	17	16.5	3.75	7	17	3.75	7	17		F
966	8-30R-E2	yes	6.5	18	8	3.8	9	5	4.2	10	5.5		S
967	6-30R-B3	yes	6.5	12	10.5	None			4.7	8	11.5		F
968	3-15L-D3	yes	6.5	17.5	6.5	3.8	8.5	11.5	4	10	11		F
969	9-30L-F5	yes	6.5	17.5	9	3.7	8	15	3.9	9	15		F
970	7-30L-D4	yes	6.5	15.5	14	3.4	6.5	18	6.3	15	14.5		S
971	3-15L-D3	yes	6.5	17	4	3.8	8	8.5	4.9	12	6		S
972	9-30L-F5	yes	6.5	18	15.5	4	8.5	16	4	8.5	16		F
973	4-15R-E2	yes	6.5	17.5	15	4	8.5	16.5	5.5	13.5	15		F
974	2-15R-C4	no	6.4	15	>20	None			None				F
975	5-15L-F5	yes	6.5	17	18.5	3.9	9	>20	5.2	13.5	19		F
976	8-30R-E2	yes	6.5	18	9	3.8	9	8.5	4.7	12.5	8.5		S
977	6-30R-B3	yes	6.5	14	9	None	7	9.5	5	8.5	8.5		S
978	10-30R-G5	yes	6.5	17	>20	3.25	6.5	>20	5.4	13	>20		F
979	7-30L-D4	no	6.5	16	18.5	3.25	6	>20	3	5	>20	Fired 0.5 sec. After R_{min}	F
980	1-15L-A4	yes	6.4	15	>20	None			5.3	12	>20		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 12.5

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 18°
Set No. 2

Run No.	Code[1]	Fired between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
981	7-30L-D4	no	6.5	14.5	>20	None			None				F
982	10-30R-G5	yes	6.5	17	>20	3.75	8	18.5	4	8.5	18.5		F
983	1-15L-A4	no	None			None			None				F
984	9-30L-F5	yes	6.5	17.5	9	3.8	8	12.5	5	12.5	10.5		S
985	3-15L-D3	yes	6.5	18	1.5	3.9	8	4	4.7	12	3.5		S
986	2-15R-C4	yes	6.5	18	9.5	3.75	6.5	8	4.5	9.5	8		S
987	8-30R-E2	no	6.5	18	11.5	3.9	8.5	16.5	3.6	8	17.5	Fired 0.4 sec. After R_{min}	F
988	5-15L-F5	yes	6.5	17	20	3.75	8	>20	5	12	>20		F
989	6-30R-B3	no	6.5	12	8	None			None			Could Have Fired	F
990	4-15R-E2	yes	6.5	17	18.5	3.9	8	>20	5.2	13	>20		F
991	2-15R-C4	yes	6.5	14.5	>20	None			5	9	>20		F
992	5-15L-F5	yes	6.5	16.5	2	4.1	7	2.5	5	11	1		S
993	7-30L-D4	yes	6.5	14	19.5	3	4	>20	4.5	9	20		F
994	9-30L-F5	yes	6.5	17	6	3.8	7	3.5	5	11.5	0.5		S
995	4-15R-E2	yes	6.5	17	18	3.9	8	>20	4.5	10	>20		F
996	3-15L-D3	no	6.5	17	6	3.9	8	7	3.6	7	7.5	Fired 0.5 sec. After R_{min}	F
997	10-30R-G5	yes	6.4	17	>20	3.2	6	>20	5.2	12	>20		F
998	1-15L-A4	no	None			None			None				F
999	6-30R-B3	yes	6.5	14	11.5	None			4.3	9	>20		F
1000	8-30R-E2	no	6.5	18	9.5	4	9	9	3.5	7	9	Fired 0.7 sec. After R_{min}	F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 13

Summary of Results

Attack-While-Search Mode
Deviated Pursuit, Lead Angle 25°
Set No. 1

Code	1-15R-A4	2-15L-C4	3-15R-D3	4-15L-E2	5-15R-F5	6-30L-B3	7-30R-D4	8-30L-E2	9-30R-F5	10-30L-G5	Totals
Successes	3	9	6	0	0	6	7	6	2	0	39
Failures Due to Launch Heading Errors	6	1	4	10	10	3	2	4	7	10	57
Failures Due to Firing Before R_{max}						1	1				2
Failures Due to Firing After R_{min}											
Failure to Fire When Permissible	1								1		2
Total Runs Made	10	10	10	10	10	10	10	10	10	10	100
Potential Successes If Fired At R_{max}	5	10	7	0	0	8	10	7	6	0	53

Total No. Valid Runs = 100
Total No. Successes = 39

Total No. Potential Successes
if Fired at R_{max} = 53
% Success = 39%
% Potential Success = 53%

TABLE 13.1

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1001	8-30L-E2	yes	6.4	19.5	15.3	3.75	9.0	16.4	3.8	10	16		F
1002	1-15R-A4	no	6.5	10.5	17.5	None			None			Did Not Fire	F
1003	3-15R-D3	yes	6.3	19	7.9	3.6	7.0	18.5	4.2	11	15.8		F
1004	2-15L-C4	yes	6.3	16.5	10.2	3.5	6.5	12.5	5.1	12.5	12		S
1005	10-30L-G5	yes	6.3	19	>20	3.6	8.5	>20	4.7	13.5	>20		F
1006	7-30R-D4	yes	6.3	14	7.1	3.5	7.0	9.5	5.0	12	8		S
1007	5-15R-F5	yes	6.4	16	>20	None			4.0	9.0	>20		F
1008	4-15L-E2	no	6.5	19	19.5	3.8	8.5	>20	6.5	20	19.5	Fired 0.2 sec. Before R_{max}	F
1009	9-30R-F5	yes	6.5	19.5	18	3.7	8.5	>20	5.4	16.5	18.5		F
1010	6-30L-B3	no	6.3	15.0	14.9	None			6.4	16.5	14.5	Fired .5 sec. Before R_{max}	F
1011	4-15L-E2	yes	6.5	18.5	>20	3.7	8.0	>20	5.5	17.5	>20		F
1012	3-15R-D3	yes	6.5	18.5	11	3.75	8.0	13	5.5	15	12.2		S
1013	2-15L-C4	yes	6.3	15	15	3.7	8.0	8.0	5.4	14	14		S
1014	8-30L-E2	yes	6.5	18.5	16.5	3.3	6.0	>20	5.5	15	18.5		F
1015	7-30R-D4	yes	6.4	16.5	7.0	3.6	6.0	11	5.7	15	7.0		S
1016	1-15R-A4	yes	6.4	14.5	1.4	3.0	3.8	1.8	4.8	10.5	2.8		S
1017	10-30L-G5	yes	6.5	18	>20	3.0	5.0	>20	6.5	18	>20		F
1018	6-30L-B3	yes	6.3	15	20.5	None			6.3	15	10.5		S
1019	9-30R-F5	yes	6.5	18	13.5	3.75	4.5	>20	5.3	14.5	16.5		F
1020	5-15R-F5	yes	6.4	18.5	>20	3.5	8.0	>20	5.2	13	>20		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 13.2

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1021	9-30R-F5	yes	6.5	19	17.5	3.75	8.5	>20	6.0	17.0	18		F
1022	10-30L-G5	no	6.5	18	>20	None			6.6	19	>20	Fired 0.5 sec. Before R_{max}	F
1023	4-15L-E2	yes	6.5	18	>20	3.8	8.5	>20	6.2	17.5	>20		F
1024	1-15R-A4	yes	6.5	14	>20	None			3.6	4.0	>20		F
1025	2-15L-C4	yes	6.5	19	5.6	3.75	8.5	4.5	6.5	19.0	5.6		S
1026	3-15R-D3	yes	6.5	18.5	10	3.75	8.5	16	5.5	15.5	11.5		S
1027	7-30R-D4	yes	6.5	16	4.0	3.6	6.0	2.0	5.6	14	3.5		S
1028	5-15R-F5	yes	6.5	18.5	>20	3.6	7.5	>20	6.3	18	>20		F
1029	6-30L-B3	yes	6.5	12	16	None			5.9	10	17		F
1030	8-30L-E2	yes	6.5	19	5.5	3.9	8.5	4.0	5.3	14	4.5		S
1031	1-15R-A4	no	6.4	14	19	2.3	5	>20	None			Didn't Fire	F
1032	2-15L-C4	yes	6.4	16	12.8	3.7	8.0	4.5	6.1	15.5	12.2		S
1033	8-30L-E2	yes	6.3	19	5.1	3.75	9.0	9.2	5.8	7.0	5.5		S
1034	6-30L-B3	no	6.5	15	10.8	None			6.6	16	9.8	Fired 0.4 sec. Before R_{max}	F
1035	5-15R-F5	yes	6.5	18	>20	3.7	9.0	>20	6.2	17	>20		F
1036	9-30R-F5	yes	6.5	18	14	3.75	8.5	17	5.5	15	14.3		S
1037	3-15R-D3	yes	6.5	19.0	12.8	3.6	7.5	>20	5.5	17	14.9		S
1038	4-15L-E2	yes	6.5	19	>20	3.6	7.0	>20	5.2	14.0	>20		F
1039	10-30L-G5	yes	6.5	18.5	>20	3.6	8.0	>20	5.5	14.5	>20		F
1040	7-30R-D4	no	6.5	15	3.2	3.6	7.0	1.0	7.0	17	3.0	Fired 0.9 sec. Before R_{max}	F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 13.3

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1041	3-15R-D3	yes	6.5	18.5	9.4	3.8	8.5	16.5	6.0	16.5	10.5		S
1042	9-30R-F5	yes	6.5	19	>20	3.8	8.5	>20	5.8	17	>20		F
1043	10-30L-G5	yes	6.5	18	16.8	4.0	6.5	>20	4.4	10	19.2		F
1044	1-15R-A4	yes	6.4	17	10.1	2.5	4.5	18.8	4.3	6.0	15		F
1045	5-15R-F5	yes	6.5	17.5	>20	3.2	5.5	>20	5.5	12.5	>20		F
1046	8-30L-E2	yes	6.4	19	10.5	3.75	8.0	16.2	4.5	11.5	14.2		F
1047	2-15L-C4	yes	6.4	19	11.2	3.75	9.0	15.1	4.0	9.0	14.9		F
1048	7-30R-D4	yes	6.5	18	5.2	3.75	7.0	11.5	5.0	12	10		S
1049	6-30L-B3	yes	6.5	13.5	7.5	2.5	4.0	>20	5.4	9.0	7.0		S
1050	4-15L-E2	no	6.5	18	18.5	3.8	9.0	>20	3.4	6.0	>20	Fired 1 sec. After R_{min}	F
1051	8-30L-E2	yes	6.4	19	1.5	3.9	9.0	8.0	4.4	10	7.1		S
1052	10-30L-G5	yes	6.5	18.5	>20	3.6	7.0	>20	5.5	16.5	>20		F
1053	3-15R-D3	yes	6.5	19	17	3.8	9.0	>20	4.3	10	>20		F
1054	4-15L-E2	yes	6.5	18	17.2	4.0	8.0	18	6.0	15.5	17.2		F
1055	7-30R-D4	yes	6.5	16	14.8	3.25	5.5	>20	5.2	11.0	>20		F
1056	5-15R-F5	yes	6.5	18.5	>20	3.7	8.0	>20	5.5	14.0	>20		F
1057	1-15R-A4	yes	6.5	15	9.5	2.5	4.5	>20	6.2	14	11.5		S
1058	9-30R-F5	yes	6.5	18.5	14.5	3.8	8.0	>20	5.5	14.5	16.5		F
1059	6-30L-B3	yes	6.5	12	>20	None			4.6	9.5	>20		F
1060	2-15L-C4	yes	6.5	17	0.5	3.7	7.0	0.6	6.0	15	1.0		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 13.4

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	RFire (n.m.)	E_{max} (deg)	E_R (deg)		
1061	10-30L-G5	yes	6.5	18	>20	3.6	8.0	>20	5.5	14	>20		F
1062	4-15L-E2	yes	6.5	17.5	16	3.8	8.0	>20	5.5	13.5	17.5		F
1063	1-15R-A4	no	6.5	15	>20	None			None			Didn't Fire	F
1064	2-15L-C4	yes	6.3	17.5	4.0	3.6	5.5	8.2	4.2	8.5	6.5		S
1065	5-15R-F5	yes	6.3	17.5	>20	3.2	5.5	>20	4.3	9.0	>20		F
1066	8-30L-E2	yes	6.3	18	16.5	3.75	8.0	11.8	5.2	14.5	10.2		S
1067	6-30L-B3	yes	6.5	15	7.8	2.9	4.2	13.7	5.7	13	8.5		S
1068	3-15R-D3	yes	6.5	18	9	3.75	8.0	13	5.3	13	11		S
1069	9-30R-F5	yes	6.5	17	8.5	3.8	7.0	14.0	4.5	10	12.5		F
1070	7-30R-D4	yes	6.4	15.5	7.5	3.7	6.0	13	5.5	13	8.6		S
1071	3-15R-D3	yes	6.4	18	17	3.9	7.0	15.5	4.4	10	16.5		F
1072	9-30R-F5	no	6.4	17	7.5	3.8	8.0	8.0	None			Did Not Fire When Permissible	F
1073	4-15L-E2	yes	6.4	18	>20	3.75	8.0	>20	5.4	15	>20		F
1074	2-15L-C4	yes	6.3	17	12	3.7	8.0	12	4.8	12	11.2		S
1075	5-15R-F5	yes	6.5	18	>20	3.75	16	>20	5.5	16.5	>20		F
1076	8-30L-E2	yes	6.3	18	9.5	3.75	7.0	13.5	4.3	10.5	12.5		F
1077	6-30L-B3	yes	6.5	15	10.1	None			6.5	15	10.1		S
1078	10-30L-G5	yes	6.5	18	20	3.8	8.0	>20	5.0	11	>20		F
1079	7-30R-D4	no	6.4	16	>15.1	3.3	6.0	>20	None			Didn't Fire	F
1080	1-15R-A4	yes	6.5	14.5	7.3	3.5	4.5	8.2	5.4	12.0	7.9		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 13.5

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1081	7-30R-D4	yes	6.3	16.5	10.9	3.5	6.0	11	6.1	16	11		S
1082	10-30L-G5	yes	6.3	18.5	>20	3.75	8.0	>20	5.3	14	>20		F
1083	1-15R-A4	no	6.4	14.5	3.5	3.25	4.5	16.5	None			Didn't Fire When Permissible	F
1084	9-30R-F5	yes	6.3	18	>20	3.6	8.5	>20	5.1	13.5	>20		F
1085	3-15R-D3	yes	6.3	18	18	3.75	8.0	>20	5.2	14.5	19.5		F
1086	2-15L-C4	yes	6.3	18.5	5.0	3.75	8.0	9.5	5.2	15	4.0		S
1087	8-30L-E2	yes	6.3	18.5	4.5	3.75	8.0	9.5	5.4	16.5	5.5		S
1088	5-15R-F5	yes	6.3	18	>20	None			4.8	10	>20		F
1089	6-30L-B3	yes	6.3	13.5	10	None			3.1	11	10.5		S
1090	4-15L-E2	yes	6.25	17.5	18	3.8	8.0	>20	5.0	13	19.2		F
1091	2-15L-C4	yes	6.4	17	6.9	3.7	6.5	15.5	5.6	15.5	8.0		S
1092	5-15R-F5	yes	6.3	18	19.9	3.8	6.5	>20	4.4	10	>20		F
1093	7-30R-D4	yes	6.4	15.5	4.0	3.7	6.5	1.6	5.4	12	4.0		S
1094	9-30R-F5	yes	6.25	18	9.0	3.8	8.0	18	5.4	15.5	10.8		S
1095	4-15L-E2	yes	6.3	18	16	4.0	8.0	15.9	5.3	15.5	16		F
1096	3-15R-D3	yes	6.3	8.5	10.2	3.9	8.0	8.6	5.6	15.5	10.7		S
1097	10-30L-G5	yes	6.3	19	>20	3.75	7.0	>20	5.3	15.5	>20		F
1098	1-15R-A4	yes	6.4	12.5	>20	None			4.6	10.0	>20		F
1099	6-30L-B3	yes	6.5	13	6.6	None			5.5	10	9.6		S
1100	8-30L-E2	yes	6.4	18	6.5	3.9	8.0	6.0	5.4	14.5	5.0		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 13.4

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 1

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1061	10-30L-G5	yes	6.5	18	>20	3.6	8.0	>20	5.5	14	>20		F
1062	4-15L-E2	yes	6.5	17.5	10	3.8	8.0	>20	5.5	13.5	17.5		F
1063	1-15R-A4	no	6.5	15	>20	None			None			Didn't Fire	F
1064	2-15L-C4	yes	6.3	17.5	4.0	3.6	5.5	8.2	4.2	8.5	6.5		S
1065	5-15R-F5	yes	6.3	17.5	>20	3.2	5.5	>20	4.3	9.0	>20		F
1066	8-30L-E2	yes	6.3	18	16.5	3.75	8.0	11.8	5.2	14.5	10.2		S
1067	6-30L-B3	yes	6.5	15	7.8	2.9	4.2	13.7	5.7	13	8.5		S
1068	3-15R-D3	yes	6.5	18	9	3.75	8.0	13	5.3	13	11		S
1069	9-30R-F5	yes	6.5	17	8.5	3.8	7.0	14.0	4.5	10	12.5		F
1070	7-30R-D4	yes	6.4	15.5	7.5	3.7	6.0	13	5.5	13	8.6		S
1071	3-15R-D3	yes	6.4	18	17	3.9	7.0	15.5	4.4	10	16.5		F
1072	9-30R-F5	no	6.4	17	7.5	3.8	8.0	8.0	None			Did Not Fire When Permissible	F
1073	4-15L-E2	yes	6.4	18	>20	3.75	8.0	>20	5.4	15	>20		F
1074	2-15L-C4	yes	6.3	17	12	3.7	8.0	12	4.8	12	11.2		S
1075	5-15R-F5	yes	6.5	18	>20	3.75	16	>20	5.5	16.5	>20		F
1076	8-30L-E2	yes	6.3	18	9.5	3.75	7.0	13.5	4.3	10.5	12.5		F
1077	6-30L-B3	yes	6.5	15	10.1	None			6.5	15	10.1		S
1078	10-30L-G5	yes	6.5	18	20	3.8	8.0	>20	5.0	11	>20		F
1079	7-30R-D4	no	6.4	16	>15.1	3.3	6.0	>20	None			Didn't Fire	F
1080	1-15R-A4	yes	6.5	14.5	7.3	3.5	4.5	8.2	5.4	12.0	7.9		S

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 14

Summary of Results

Attack-While-Search Mode
Deviated Pursuit, Lead Angle 25°
Set No. 2

Code	1-15L-A4	2-15R-G4	3-15L-D3	4-15R-E2	5-15L-F5	6-30R-B3	7-30L-D4	8-30R-E2	9-30L-F5	10-30R-G5	Totals
Successes		5	1				4	2			12
Failures Due to Launch Heading Errors	10	5	9	10	10	10	5	7	9	10	85
Failures Due to Firing Before R_{max}											
Failures Due to Firing After R_{min}									1		1
Failure to Fire When Permissible							1	1			2
Total Runs Made	10	10	10	10	10	10	10	10	10	10	100
Potential Successes If Fired at R_{max}	2	8	3			4	8	6	2		33

Total No. Valid Runs = 100
Total No. Successes = 12
Total No. Potential Successes = 33

Percent Success = 12
Percent Potential Success = 33

TABLE 14.1

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max} (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1101	8-30R-E2	yes	6.5	18	11	4	9	10.5	4	9	10.5		F
1102	1-15L-A4	yes	6.4	13	20	None			5.5	8.5	19.5		F
1103	3-15L-D3	no	6.5	18	20	3.7	7	>20	3.4	6	>20	Fired 0.4 sec. After R_{min}	F
1104	2-15R-C4	yes	6.5	18	5.5	4	8	4.5	4.3	10	4.5		S
1105	10-30R-G5	yes	6.5	18	>20	3.8	8	>20	4.5	11	>20	Fired 3.7 sec. After R_{min}	F
1106	7-30L-D4	no	6.5	17	6.5	3.75	7	19.5	2.5	2.5	>20		F
1107	5-15L-F5	yes	6.5	15	>20	None			4.7	10	>20		F
1108	4-15R-E2	yes	6.5	18	>20	3.6	7.5	>20	3.7	7.5	>20		F
1109	9-30L-F5	yes	6.5	18	>20	3.75	8	>20	4.5	11.5	>20		F
1110	6-30R-B3	yes	6.5	14	13.5	None			4.5	7.5	18.5		F
1111	4-15R-E2	yes	6.5	17	19.5	3.9	8	>20	5	13	>20		F
1112	3-15L-D3	yes	6.5	17.5	17.5	3.7	5	>20	4.5	8	>20		F
1113	2-15R-C4	yes	6.5	17.5	7.5	3.7	7	8.5	5.2	13	8.5		S
1114	8-30R-E2	yes	6.5	17.5	16	4	8.5	15	4	8.5	15		F
1115	7-30L-D4	yes	6.5	16	8	3.75	5.5	10.5	4.9	9	8.5		S
1116	1-15L-A4	no	6.5	13	>20	None			None				F
1117	10-30R-G5	yes	6.5	17.5	>20	3.6	5	>20	4	7	>20		F
1118	6-30R-B3	yes	6.5	12	8.5	3	4	17	3.5	5	10		F
1119	9-30L-F5	yes	6.5	18	>20	3.9	6	>20	4.5	9.5	>20		F
1120	5-15L-F5	yes	6.5	17	>20	3.9	5	>20	4.4	7	>20		F

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 14.2

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max} (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1121	9-30L-F5	yes	6.5	17	13.5	3.9	7	15.5	4.5	10	14		F
1122	10-30R-G5	yes	6.5	16	16.5	4	7	>20	5	11	>20		F
1123	4-15R-E2	yes	6.5	17.5	>20	4	7	>20	5.2	13.5	>20		F
1124	1-15L-A4	no	6.5	10	>20	None			3.2	11	>20	Fired Outside R_{max}	F
1125	2-15R-C4	yes	6.5	15	9.5	3.9	6	10	4	7	10		F
1126	3-15L-D3	yes	6.5	16	>20	3.9	7	>20	4.7	11	>20		F
1127	7-30L-D4	yes	6.5	15	1	3.8	6	6	4.5	8.5	4		S
1128	5-15L-F5	yes	6.5	17	>20	3.8	7	>20	4	8	>20		F
1129	6-30R-B3	no	6.5	11	14.5	None			7	13.5	14.5	Fired 1.4 sec. Before R_{max}	F
1130	8-30R-E2	yes	6.5	17	6.5	4	7	11.5	4	7	11.5		F
1131	1-15L-A4	yes	6.5	14	14	2.8	4	10.5	5.5	12	13		F
1132	2-15R-C4	no	6.5	13	>20	None			6.8	14.5	>20	Fired 0.4 sec. Before R_{max}	F
1133	8-30R-E2	no	6.5	17	8.5	4	8	14	None			Could Have Fired	F
1134	6-30R-B3	yes	6.5	13	7.5	None			4.8	8	12		F
1135	5-15L-F5	yes	6.5	17	>20	3.8	7	>20	4.5	10	>20		F
1136	9-30L-F5	no	6.5	16	8.5	3.9	7	13.5	3.5	5	15	Fired 0.9 sec. After R_{min}	F
1137	3-15L-D3	yes	6.5	18	16	4	8	>20	5	12.5	>20		F
1138	4-15R-E2	no	6.5	17	>20	3.9	8	>20	None				F
1139	10-30R-G5	yes	6.5	16.5	>20	4	6	>20	4.3	7	>20		F
1140	7-30L-D4	yes	6.5	16	10.5	3.8	6	5	4.7	8.5	5.5		S

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 14.3

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max} (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1141	3-15L-D3	yes	6.5	17	>20	3.8	6	>20	4.5	9	>20		F
1142	9-30L-F5	yes	6.5	17	20	3.8	6	>20	4.8	11	>20		F
1143	10-30R-G5	yes	6.5	16.5	>20	3.8	7	>20	3.8	7	>20		F
1144	1-15L-A4	yes	6.5	14.5	8.5	3.4	5	17.5	4.8	9	10		F
1145	5-15L-F5	yes	6.5	16	>20	3.6	5	>20	4.6	8	>20		F
1146	8-30R-E2	no	6.5	17.5	16.5	4	8	15	3	4	15.5	Fired 1.7 sec. After R_{min}	F
1147	2-15R-C4	yes	6.5	16	6.5	3.6	6	13	4.8	10	10		S
1148	7-30L-D4	yes	6.5	15	20	3.4	5	19	4.5	7.5	16.5		F
1149	6-30R-B3	yes	6.5	12	14	2.5	4	18	4.5	7	16.5		F
1150	1-15R-E2	yes	6.5	17	20	3.9	7	>20	4.3	8	>20		F
1151	8-30R-E2	yes	6.5	16	>20	3.9	7	>20	4	9	>20		F
1152	10-30R-G5	yes	6.5	17	>20	4	7	>20	4.3	9.5	>20		F
1153	3-15L-D3	yes	6.5	17	10.5	3.8	8	>20	4.3	9.5	20		F
1154	4-15R-E2		6.5		>20	3.9		>20			>20		F
1155	7-30L-D4	no	6.5	16	5	3.75	6.5	16.5	None			Could Have Fired	F
1156	5-15L-F5	yes	6.5	14	>20	None			5	7.5	>20		F
1157	1-15L-A4	no	None			None			None				F
1158	9-30L-F5	yes	6.5	17	>20	3.9	7	>20	4.5	10	>20		F
1159	6-30R-B3	yes	6.5	13	>20	None			4	3.5	>20		F
1160	2-15R-C4	yes	6.5	17	8	4	7	5.5	5	12	2		S

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 14.4

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1161	10-30R-G5	yes	6.5	16	>20	3.9	6	>20	4.6	10	>20		F
1162	4-15R-E2	yes	6.5	18	>20	3.7	7	>20	4.8	12	>20		F
1163	1-15L-A4	yes	None			None			4.7	12.5	>20		F
1164	2-15R-C4	yes	6.5	17	10	4	8.5	10.5	4	8.5	10.5		F
1165	5-15L-F5	yes	6.5	18	>20	3.75	8	>20	4.5	11	>20		F
1166	8-30R-E2	yes	6.5	18	14	4	8	12	4	8	12		F
1167	6-30R-B3	yes	6.5	12	>20	None			5.2	8.5	>20		F
1168	3-15L-D3	yes	6.5	18	11.5	3.°	7	>20	4.5	10.5	19.5		F
1169	9-30L-F5	yes	6.5	17	15.5	4	7	>20	4.8	11	19		S
1170	7-30L-D4	yes	6.5	16	2	3.75	6	11	4.6	9	8		F
1171	3-15L-D3	yes	6.5	18	>20	4	8	>20	4.5	11	>20		F
1172	9-30L-F5	yes	6.5	18	>20	4	8	19	4	8	19		F
1173	4-15R-E2	yes	6.5	17	>20	3.9	7	>20	4.5	10	>20		S
1174	2-15R-C4	yes	6.5	16	5	3.8	7	8	4.2	8	8		F
1175	5-15L-F5	yes	6.5	18	>20	3.9	8	>20	5	11.5	>20		S
1176	8-30R-E2	yes	6.5	18	9.5	4.1	8	6	5.5	13.5	7.5		F
1177	6-30R-B3	yes	6.5	12	13.5	None			4.5	8	13		F
1178	10-30R-G5	yes	6.5	18	>20	3.8	8	>20	5.6	15	>20		F
1179	7-30L-D4	yes	6.5	16.5	6.5	3.7	6	17	4.5	9	13.5		F
1180	1-15L-A4	no	6.5	10	>20	2.5	5	>20	None				

Notes:
1. For definition of code, refer to text.
2. S - The missile is successfully launched.
   F - An attack failure occurs.
   I - Run is incomplete.
3. Useful range of Emax is 0 to 15 degrees.

TABLE 14.5

Results of Simulation

Attack-While-Search Mode Evaluation
Deviated Pursuit, Lead Angle 25°
Set No. 2

Run No.	Code[1]	Fired Between R_{max} & R_{min}	Data at R_{max}			Data at R_{min}			Data at Firing Point			Remarks	Evaluation[2]
			R_{max} (n.m.)	E_{max}[3] (deg)	E_R (deg)	R_{min} (n.m.)	E_{max} (deg)	E_R (deg)	R_{Fire} (n.m.)	E_{max} (deg)	E_R (deg)		
1181	7-30L-D4	yes	6.5	16	14	3.7	5	>20	5.1	10.5	20		F
1182	10-30R-G5	yes	6.5	17.5	17.5	3.75	8	>20	5.3	12	19.5		F
1183	1-15L-A4	yes	6.5	14	16	None			4.9	7	17.5		F
1184	9-30L-F5		6.5		>20	4.0		>20			>20		F
1185	3-15L-D3	yes	6.5	18	14	4	8	14	6	17.5	14.5		S
1186	2-15R-C4	yes	6.5	18	9	3.75	7	16	4.9	10	15		F
1187	8-30R-E2	yes	6.5	18	5	3.75	9	2	5.5	15	3.5		S
1188	5-15L-F5	yes	6.5	18	>20	3.9	9	>20	4.8	13	>20		F
1189	6-30R-B3	yes	6.5	16	14	None			4.8	10	20		F
1190	4-15R-E2	no	6.5	19	>20	4.0	8	>20	3.6	7	>20	Fired 0.6 sec. After R_{min}	F
1191	2-15R-C4	no	6.5	17	>20	3.9	8	20	3.4	6	>20	Fired 0.8 sec. After R_{min}	F
1192	5-15L-F5	yes	6.5	16.5	>20	4.0	7	>20	5.8	12.5	>20		F
1193	7-30L-D4	yes	6.5	15	>20	3.7	5	>20	5.3	8.5	>20		F
1194	9-30L-F5	yes	6.5	17	>20	4.0	7	>20	5.8	11.5	>20		F
1195	4-15R-E2	yes	6.5	17	>20	4.0	7	>20	4.5	8	>20		F
1196	3-15L-D3	yes	6.5	17	>20	3.9	7	>20	6	14	>20		F
1197	10-30R-G5	yes	6.5	16.5	>20	3.8	6	>20	5.5	11	>20		F
1198	1-15L-A4	yes	6.5	13.5	>20	3.0	3	>20	6.4	13.5	>20		F
1199	6-30R-B3	yes	6.5	12.5	>20	None			5	7	>20		F
1200	8-30R-E2	yes	6.5	17	>20	4.0	7	>20	6	12.5	>20		F

Notes: 1. For definition of code, refer to text.
2. S - The missile is successfully launched.
F - An attack failure occurs.
I - Run is incomplete.
3. Useful range of E_{max} is 0 to 15 degrees.

TABLE 15

Summary of Fire Control Investigation

Mode	% Success	% Success Relative to Normal Attack Mode
Normal	83.7	100.0
HOJ	73.0	87.2
AOJ	36.5	43.6
Attack While Search (10° Lead Angle)	42.0	50.2
Attack While Search (18° Lead Angle)	40.7	48.6
Attach While Search (25° Lead Angle)	25.5	30.4

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